SUBMISSION TO PRODUCTIVITY COMMISSION

This submission is based on 15 years of experience as a chief executive of an environmental regulatory agency in both Western Australia (Department of Environmental Protection, 1994 to 2001) and New Zealand (Canterbury Regional Council, 2003 to 2011). Concepts and case studies are set out below in relation to:

(1) Project approval processes
(2) Regulatory practice
(3) Management and compliance arrangements
(4) Government involvement, and
(5) Effective community engagement.

1. Project Approval Processes

One of the key issues for proponents in relation to project approval processes is understanding the environmental requirements in advance of project design. A major concern is the uncertainty of the outcome of the environmental impact assessment process. Knowledge of the environmental requirements means that the proponent can incorporate these requirements into their feasibility studies and project design rather than having to modify projects to address environmental impacts after the EIA process. Three examples of ways this has been achieved are as follows:

(i) Define environmental requirements in advance
(ii) Undertake strategic environmental assessments in advance of projects, and
(iii) Develop regional sustainability strategies to define compatible projects.

1.1 Definition of environmental requirements

A good example of defining environmental requirements in advance is the approach taken in Western Australia. Commencing in 1994, the WA Department of Environmental Protection developed "Guidance Statements for the Assessment of Environmental Factors" for the Environmental Protection Authority covering the 50 main issues that arose in environmental impact assessment. Draft guidance statements were circulated to stakeholders for comment before being finalised taking consideration of the comments.

Appendix 1 describes how the guidance statement for greenhouse gas emissions was addressed by proponents of three major resource developments: the Murrin Murrin Nickel-Cobalt project expansion, the Gas to Synthetic Hydrocarbons Plant on Burrup Peninsula, and, the Gorgon Gas Development Expansion on Barrow Island.

The WA Environmental Protection Authority was selected as the recipient of the Regional Award by the International Association of Impact Assessment in 2019 for its sustained contributions to good practice in impact assessment in Australia for its proactive and pioneering work in developing policy and guidance material.

1.2 Strategic Environmental Assessment and Staged Assessment

An evolution in environmental practice was to bring environmental considerations earlier into the development decision making process. One approach was strategic environmental assessment. The term strategic environmental assessment refers to a systematic process of analysing the

environmental effects of policies, plans and programmes.[1] In Australia, this was first introduced in Western Australia in 1995 as advice to the Minister. The WA Environmental Protection Act was amended in 2003 to allow formal assessment of strategic proposals. A second was staged (or tiered) assessment. Staged assessment means coverage of general matters and critical environmental effects in an environmental impact report followed by narrower or site-specific environmental reports on effects which are capable of being mitigated or not analysed as significant effects in the prior environmental impact report.[2]

Examples of these approaches are summarised below: the Oakajee Industrial Estate as an example of strategic assessment, and, Ord River Irrigation Area Stage 2 as an example of staged assessment.

OAKAJEE INDUSTRIAL ESTATE: EXAMPLE OF STRATEGIC ASSESSMENT

One area where strategic environmental assessments were effective in WA was in relation to managing environmental effects of industrial proposals. SEAs were conducted for industrial estates in areas where industrial plants were anticipated. This enabled identifying issues in advance of development proposals and allowed time for baseline studies and investigations of potential environmental problems as well defining appropriate buffer zones for issues like noise. Box 1 shows the siting of the Geraldton Steel Plant proposal within the Oakajee Industrial Estate. This facilitated the avoidance of sensitive environmental areas and the creation of appropriate buffer zones in advance of the steel plant proposal. It also enabled the undertaking of hydrological investigations in advance of project proposals to determine the acceptability of liquid waste treatment in an area of limestone.

ORD RIVER IRRIGATION AREA STAGE 2: EXAMPLE OF STAGED ASSESSMENT

The original proposal for the Ord River Irrigation Scheme Stage 2 (M2 Supply Channel) was for approximately 36,000 ha of irrigated farms, a 400,000 ton per annum sugar mill, and associated infrastructure (Kinhill 2000a)[3]. A two-stage assessment process was undertaken. The first stage was to assess the implications for biodiversity because of the regional significance of the flora and fauna in the project area and the potential loss of up to 50,000 ha of vegetation through clearing.

Because of the size of the project area, the EPA considered that the co-proponents alone may not be able to protect biological diversity. The EPA indicated that participation of the Western Australian and Northern Territory Governments in regional land use initiatives may be necessary to address biodiversity issues. Further conservation reserves may be required outside the project area in the Victoria-Bonaparte Biogeographic Region.

The cracking-clay black-soil plains within the project area would be the predominant soil type subjected to development. It was the biodiversity associated with the cracking-soil plains that had regional significance. However, there were only limited areas within the conservation reserve system.

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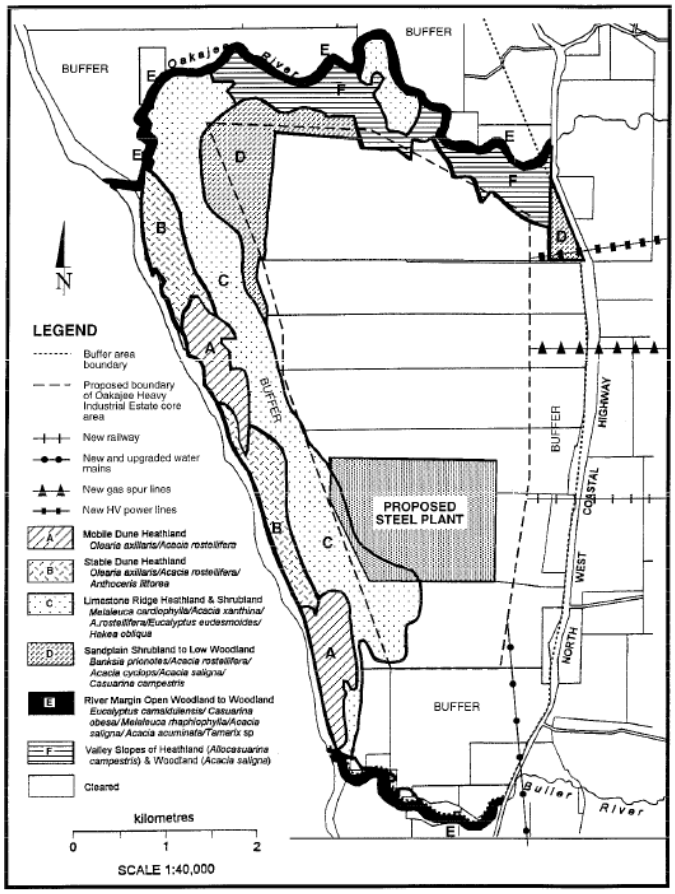
[1] Dalal-Clayton, B. and Sadler, B. (2005) Strategic Environmental Assessment: A Sourcebook and Reference Guide to International Experience, Earthscan, London.

[2] California Environmental Quality Act (CEQA) Statute and Guidelines, para 21068.5

[3] Kinhill (2000a) Ord River Irrigation Area Stage 2 Proposed Development of the M2 Area: Environmental Review and Management Programme / Draft Environmental Impact Statement, Wesfarmers Sugar Company, Marabeni Corporation, and The Water Corporation of Western Australia, Perth.

Box 1 Oakajee Industrial Estate Strategic Environmental Assessment[4]

Geraldton Steel Plant Proposal sited within Oakajee Estate avoiding sensitive vegetation and within designated buffers[5]



The SEA for the Oakajee Industrial Estate provided early identification of sensitive environments, buffer requirements and potential environmental problems. One concern was in relation to wastewater disposal over Tamala limestone with karstic cavities. Hydrogeological investigations determined the permeability of sediments and underlying limestone groups, and, the absence of paleochannels. Adequate land area was identified for solar evaporation of liquid wastes.

The subsequent proposal could be sited to avoid sensitive vegetation and within adequate buffers that had been defined during the Strategic Environmental Assessment.

To protect the biodiversity associations of conservation significance, the EPA recommended a package of areas was proposed to be managed for conservation. One component was the retention of undeveloped areas left within the project area and managed for conservation. A second component was the following additions to the conservation estate from the excision and destocking of parts of pastoral leasehold: in the Northern Territory – Spirit Hills (226,000 ha) and Western Legune (83,000 ha); and in Western Australia – Livistona Range (55,700 ha), Pincombe Range (17,900 ha), Ninbing Range (6,300 ha), Weaber Range (22,500 ha) and Mt Zimmerman (9,400 ha) (WAEPA 2000)[6].

[4] EPA (1997) Oakajee Industrial Estate – Concept, Shire of Chapman Valley, Landcorp. Bulletin 848 Advice to the Minister of the Environment from the Environmental Protection Authority under Section 16(e) of the Environmental Protection Act 1986. EPA, Perth WA.

[5] EPA (1997) Mid West Iron and Steel Project – Geraldton Steel Plant, Oakajee, Shire of Chapman Valley, Kingstream Resources NL. Bulletin 860 Report and recommendations of the Environmental Protection Authority. EPA Perth WA.

[6] WAEPA (2000) Ord River Irrigation Area Stage 2 (M2 Supply Channel), Kununurra: Part 1 – Biodiversity Implications, Report and Recommendations of the Environmental Protection Authority, Bulletin 988, Perth WA.

In designing the conservation strategy for the project area, an assessment was made of the best spatial arrangement that would efficiently represent the conservation values within the project area. Key elements of the conservation strategy are the retention of a representative associations and habitats within distinct conservation areas, the conservation area as a continuous buffer, and connections to conservation areas external to the project area. The conservation areas in the project area were modified as part of the first stage assessment. The resolution of the conservation areas at an early stage in the process enabled redesign to incorporate the conservation requirements. The second stage assessment was based on the revised design.

The assessment was that the project could meet the biodiversity criteria that had been set in the following way: (1) it was unlikely that any species of flora and fauna would become extinct; (2) the target retention of at least 30% of each vegetation association was achieved for all but two associations; (3) riparian zones around watercourses and wetlands had been excluded from development; and, (4) buffer zones would become a component of a much larger conservation reserve system (WAEPA, 2000).

However, with the fall in the price of sugar, the project did not proceed. Nevertheless, as part of the settlement of the Native Title Claim of the Miriuwung Gajerrong people (the Ord Final Agreement), eight areas totalling 188,200 ha were included in the Agreement to be managed for conservation and Aboriginal uses as set out in the Yoorrooyang Dawang Proposed Conservation Parks Draft Management Plan (DEC 2011)[7]. Also included in the Agreement all the land for the development of Ord Stage 2 in Western Australia including the conservation areas and agricultural buffers.

1.3 Regional Sustainability Strategies

One of the significant challenges in project-level impact assessment is the potential conflict between economic, social, environmental and cultural values especially when environmental impacts have the potential to exceed sustainability limits. One approach to addressing this issue is the preparation of regional sustainability strategies. This requires the bringing together of the multiple stakeholders associated with future developments (not just a single project) to define a strategic framework for sustainable development of resources in the region with sustainability defined in economic, social, environmental and cultural terms. This enables proponents of new projects to devise developments consistent with this strategic framework.

A good example of this approach is the development of the Canterbury Water Management Strategy (Canterbury Water, 2009)[8]. Irrigation expansion led to sustainability limits being reached for water availability and cumulative effects of land-use intensification. Increasing water availability through storage was proposed. There was strong community opposition to impacts of storage and further intensification. Effects-based institutional arrangements proved inadequate to address these issues.

The regional council introduced a strategic approach based on nested adaptive systems and collaborative governance. A regional water strategy was developed through a multi-stakeholder steering group under the Canterbury Mayoral Forum and with extensive community engagement.

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[7] DEC (2011) Yoorrooyang Dawang Proposed Conservation Parks Draft Management Plan 2011, Department of Environment and Conservation, Perth WA.

[8] Canterbury Water. 2009. *Canterbury Water Management Strategy Strategic Framework.* Christchurch: Environment Canterbury.

Zone Committees were established to develop Zone Implementation Programmes. Farmer collectives are being established for operational delivery of water management targets. Farmers developed farm management plans to meet property-level outcomes which were independently audited.

Strategy investigations demonstrated that focusing on new development would not achieve sustainable development, rather existing users also had to improve. Water-use efficiency improvements were more cost effective than new storage. Furthermore, different forms of storage, such as managed aquifer recharge, were identified to avoid adverse effects on mainstems of alpine rivers. Proactive measures were needed to address water quality degradation, biodiversity loss, Māori involvement, and ecological restoration.

A systems perspective and a governance change from regulatory to collaborative has improved water management. However, it also identified issues concerning affordability of proactive measures, equity in allocation, and need for a public infrastructure agency. Uneven implementation of measures has led to some groups withdrawing from the collaborative process.

Appendix 2 provides a summary of the development and implementation of the Canterbury Water Management Strategy.

2. Regulatory Practices that Achieved Evidence-Based Goals

Regulatory conditions set a minimum standard for environmental management with no incentive for those being regulated to adopt a higher standard of environmental performance. Two approaches that provide incentives for industry to achieve environmental performance above the minimum standard are:

(i) load-based licences
(ii) best practice licences.

These two approaches are discussed below.

2.2 Load-based Licences

The traditional approach to setting licensing fees was based on industry throughput. The greater the throughput led to greater work for the regulatory agency in undertaking monitoring and compliance activities. However, this approach provides no incentive for industry to reduce the pollutant load that it generates. In the mid-1990s, the Western Australian Department of Environmental Protection introduced load-based licences where licence fees were based on pollutant load.[9] This resulted in major polluters making efforts to reduce their pollution emissions.

2.3 Best Practice Licences

Another innovation that was introduced by the Western Australian Department of Environmental Protection as part of a package of best practice regulation measures was a “best practice licence”. These licences were designed for industries committed to best practice environmental management where the responsibility and approach to meeting environmental performance requirements was determined by industry but with government overseeing the effectiveness and independence of the

[9] Jenkins B (1996) Best Practice Environmental Regulation – The Western Australian Approach, Conference on Environmental Management Beyond 2000, Griffith University, Brisbane, 5-6 December 1996. Refer Attachment 1.

process. For an industrial premises to obtain a best practice licence it needed the following items in place:

- an environmental policy with a commitment to best practice and continuous improvement,
- environmental performance objectives agreed with the regulator based on benchmarking against best practice for similar circumstances,
- an environmental management manual indicating how operations are managed to achieve the environmental objectives with third party certification,
- an environmental audit plan for checking compliance with operational requirements and performance objectives with independent third party involvement and sign-off,
- and environmental improvement plan which sets out the goals and expected timing of the proposed improvements, and
- publicly available annual reports of environmental performance with CEO sign-off.

Two examples of best practice licences were the alumina refinery at Kwinana on the shores of Cockburn Sound operated by Alcoa and the Woodman Point wastewater treatment plant operated by the Water Corporation.[10]

3. Management and Compliance Arrangements

The general concept of regulatory practices is to set compliance conditions and monitor performance against those conditions. This approach has a number of problems in practice. One is that the setting of compliance conditions is usually undertaken by regulators who may not be aware of the most cost-effective ways to achieve compliance. The concept of "audited self management" was designed to address this and examples of its application are set out in section 3.1 below. A second is the management of cumulative effects where multiple discharges are involved. Section 3.2 discusses management and compliance arrangements to address cumulative effects. A third is the need for a risk management approach to monitoring of environmental parameters that incorporates environmental quality management and regulatory enforcement. This is discussed in section 3.3.

3.1 Audited Self Management

As an alternative to government regulation, the concept of audited self management involves the following:

- the environmental performance requirements were set by the regulator, but industry was able to determine how to meet the requirements;
- industry was required to have an environmental management system (EMS) with independent certification (either the regulator or an independent certifier);
- industry was required to undertake measurements to demonstrate environmental performance requirements had been met with the measurements audited by an independent auditor (either the regulator or an independent auditor); and
- the results of the measurements were to be publicly reported.[11]

[10] Jenkins B.R. and Hine P.T. (2003) "Benchmarking for Best Practice Environmental Management" Environmental Monitoring and Assessment, V85 p115-134. Refer Attachment 2.

[11] Jenkins, B.R. (2018) Water Management in New Zealand's Canterbury Region: A Sustainability Framework. Global Issues in Water Policy Vol. 19. Springer, Dordrecht.

An example of audited self management is the operational management of water quality associated with agricultural land use in Canterbury. The main operational elements are having farmers adopt good management practice, setting nutrient contaminant limits with respect to rivers and lakes, linking these river and lake limits to catchment nutrient loads among existing users while trying to create headroom for new users. The primary governance element is the establishment of farmer collectives based on irrigation districts, tributary catchments (or stream allocation zones), or farm enterprises. Collectives need an approved Environmental Management System (EMS) that defines water quality outcomes for the collective consistent with regional plan requirements. The EMS requires an inventory of nutrient loss rates, identification of the nutrient risks and how those risks will be managed including a statement of best nutrient management practices. The EMS also defines the contractual arrangements with members of the collective including a Farm Environment Plan (FEP) consistent with the EMS, and, how FEPs will be audited and compliance achieved. The FEP has to address irrigation management, soils management, nutrient management, effluent management as well as wetland and riparian management. There is an audit process of assessing performance against management actions and outcomes at the individual property level. The EMS sets out the record keeping requirements, how audit results will be fed back to members and shared with the wider community, and, how issues of poor performance are to be managed.

3.2 Management of Cumulative Effects

When sustainability limits for resource use or adverse effects from multiple users are reached there is a need to manage for cumulative impacts of all users as well as the impacts of individual users. Three types of situations are discussed below:

(i) managing cumulative effects where the boundaries of the entire resource can be managed (e.g. an entire water catchment or groundwater basin);
(ii) managing cumulative effects where the boundaries of resource use are in multiple jurisdictions (e.g. global issues like greenhouse gas emissions); and
(iii) managing cumulative effects of temporary use of a resource (e.g. managing the rehabilitation of multiple mining projects in the same locality).

3.2.1 Managing cumulative effects within resource boundaries

Some of the key issues in relation to managing cumulative effects are drawn from experiences in water management in Canterbury. The first is in relation to the scale of the effects that need to be managed. It is not just the geographical extent of project impacts but the broader extent of the resource boundaries. An example is water extraction from the Rakaia-Selwyn Groundwater Zone where the spatial scale of management increased from managing the drawdown impacts on adjacent bores to managing the total extraction from the groundwater zone and the effects on flows in groundwater-fed streams.

The second is in relation to cumulative effects on water quality. The management of nitrate contamination from across the Canterbury Plains required analysis of existing users (with authorised discharges) as well as future developments on drinking water quality from groundwater. This led to requirements for increased controls on existing users (despite having approvals) and raised the issue of affordability of additional controls on existing users.

The third is the complexity of modelling to predict impacts is greater for cumulative effects than modelling for project effects. Associated with this, there can be an issue relating to project approvals if the uncertainties associated with modelling cumulative effects are greater than the impacts of the project under assessment. This was an issue for dairy farm conversions in the catchment of Lake

Benmore. This creates difficulties not only in setting overall levels for managing cumulative effects but also in determining whether impacts from project proposals can be accommodated.

An issue that arises with cumulative impact management that does not occur with project assessment is the equity of allocation of resource use or contaminant discharge capacity. This fourth issue arose in setting of nitrogen discharge limits on land users in the catchment of Wainono Lagoon. This issue is not only for allocation among existing users but also between existing dischargers and potential new dischargers.

The fifth issue is the need to manage the collective contributions of those responsible for adverse effects not just the individual users. An example is the management of salinisation of the Woolston-Heathcote groundwater supply where limits on total withdrawals were needed to reduce aquifer salinisation and prevent its reoccurrence.

A related issue is the greater complexity of the monitoring required for the management of cumulative impacts. An example is the management of environmental flows in the Te Ngawai River. This required integrating measurements of individual extractions and the combined effect on river flow in real time using telecommunications and an internet site.

More information on these examples is provided in Attachment 3.

3.2.2 Managing cumulative effects across multiple jurisdictions

Managing transboundary cumulative effects is more complex because it involves the management coordination of multiple jurisdictions. One of the most difficult issues is the management of greenhouse gas emissions where the contribution of an individual project is very small, but the global aggregate of all sources is significant.

One approach associated with project approvals that has been effective is the one taken in Western Australia where there have been major resources and energy developments. As part of the environmental impact assessment process, proponents of projects with significant greenhouse gas emissions are to (1) identify all greenhouse gas emission sources and calculate emissions in accordance with the National Greenhouse and Energy Reporting Act; (2) demonstrate that the proposal is designed and will be operated in a manner which maximises energy efficiency and minimises greenhouse gas emissions as far as practicable; and, (3) provide an analysis of greenhouse gas intensity (i.e. quantity of CO_2-e generated per tonne of product produced) and consider published benchmarked best practice for equivalent plants and equipment.[12]

It is advantageous to have a multi-jurisdictional agreement on the management of cumulative effects. In the initial form of the policy the benchmarking was also against Australia's target from the 1997 Kyoto Climate Change Conference.[13] The 108% target represents a 25% reduction from "business-as-usual" predictions of greenhouse gas emissions for the year 2010 (which was 143% of 1990 levels). Industries were expected to achieve greenhouse gas emission levels that were 43% below industry performance in 1990. Examples of the outcomes from the EIA processes for major mining and hydrocarbon projects are presented in Appendix 1.

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[12] Environmental Protection Authority. (2015). *Environmental Protection Bulletin No. 24 Greenhouse gas emissions and consideration of projected climate change impacts in the EIA process*. Perth, Western Australia: Environmental Protection Authority.

[13] Environmental Protection Authority. (1998). *Guidance Statement No. 12: Minimising Greenhouse Gas Emissions*. Perth, Western Australia: Environmental Protection Authority.

3.2.3 Managing Cumulative Effects of Temporary Uses

Mining projects are an example of temporary use of the land. Land rehabilitation after mining closure is a standard requirement of project approvals. However, there are greater challenges when there are multiple mining projects in the same locality. An excellent example of how to manage multiple mining projects in the same locality is the Penrith Lakes Scheme.[14]

The Penrith area was the major source of sand and gravel for the Sydney metropolitan area. More than 160 million tonnes from the Penrith area provided around 50% of Sydney's requirements. There were multiple independent operators excavating sand and gravel. The idea to turn Penrith's sand and gravel quarries into lakes at the end of their life was first proposed in 1968. The companies then working in the area combined their land holdings and quarrying operations in a joint venture to coordinate extraction and rehabilitation of the quarry sites. They became the Penrith Lakes Development Corporation (PLDC) in 1980.

A feasibility study showed that it was technically, environmentally and economically viable to create a series of lakes in the old quarries as part of a rehabilitation solution. The NSW Government facilitated implementation of the Penrith Lakes Scheme by passing the Sydney Region Environmental Plan No 11 under the Environment Planning and Assessment Act. This Plan set out the framework for design, ongoing quarrying and future uses of the scheme. A Deed of Agreement between the NSW Government and PLDC defined standards for landform construction, water management, erosion control, landscaping, and dust and noise control, among other things.

Mining operations were then conducted to create the lake system and associated landforms for future uses. The first stage of the lakes scheme was the 196 ha Sydney International Regatta Scheme which was used for rowing events in the Sydney 2000 Olympic Games.[15]

3.3 Monitoring for Environmental Quality and Regulatory Enforcement

One of the significant issues for effective environmental monitoring and management is having appropriate criteria to address environmental risks. A general framework was developed in Western Australia across multiple media (i.e. water, soil and air). Three types of criteria were considered relevant:

- Investigation levels - these are levels of environmental quality below which there is a high level of certainty that the relevant environmental objectives would be met but the exceedance of these levels may not indicate that there had been an adverse impact on the environment;
- Environmental Standards - these are levels of environmental quality which if exceeded then management action is warranted to reduce the levels in order to maintain an acceptable level of environmental quality; and

[14] Department of Environment and Planning (1984) Penrith Lakes scheme regional environmental study, Sydney NSW.

[15] The historical information was extracted from "Penrith Lakes (2015) History of the Penrith Lakes Scheme" http://admin.penrithlakes.com.au/content/2015/03/HISTORY-OF-THE-PENRITH-LAKES-SCHEME_MARCH-2015.pdf

- Pollution limits - these are levels of environmental quality at which adverse environmental impacts are expected and at which enforcement action is warranted.

These criteria can be aligned with an appropriate action as set out in Table 1. Where ambient environmental quality is below investigation levels then the appropriate action is to continue monitoring. However, when ambient quality exceeds investigation levels then the appropriate action is to investigate the situation to determine an acceptable level of environmental quality to be maintained and take further action based on the findings of the investigations.

Where ambient quality exceeds the environmental standard then the appropriate action is to implement a management response to reduce the ambient levels so that the ambient quality returns to within the environmental standard. If the pollution limit is exceeded, then enforcement action is warranted in addition to undertaking remedial action. This framework incorporates the three ways of applying the precautionary principle. There are decision-making responses appropriate to different levels of environmental quality. There are information-gathering responses to resolve uncertainties. There are management responses to address adverse outcomes. There is also the addition of limits which trigger enforcement action when precautionary approaches are no longer sufficient.

Table 1: General framework for Environmental Criteria

Action	Environmental Quality Criterion
Enforcement ----------Pollution Limit Management ----------Environmental Standard Investigation ----------Investigation Level Monitoring ----------Background Level	

Attachment 4 provides examples of how this framework was applied in Western Australia for water quality guidelines, contaminated site assessments and air quality.

4. Government Involvement

There are several ways that government can be involved in the resources approval process to expedite project approvals without compromising community or environmental standards. These include:

(i) reducing uncertainty for the proponent through early advice of acceptability criteria,
(ii) reducing the time period for approvals through early assessment of critical issues,

(iii) management of cumulative effects,
(iv) facilitation of community engagement to resolve contentious issues,
(v) generation of solutions packages to address cumulative impacts, and
(vi) government taking a proactive role in sustainable development.

4.1 Reducing Uncertainty for Proponents

As set out in Section 1 above, governments can define environmental requirements in advance of the project approval process. This can be in a general form, like the guidance statements for the assessment of environmental factors prepared in WA. This requires a drafting process that includes community scrutiny of preliminary versions of guidance statements.

Government involvement can also be in a project-specific form, such as strategic or staged assessment. The case of the Ord River Irrigation Scheme Stage 2 (in Section 1.2 above) is an example. The WA and NT Governments developed a regional conservation strategy for cracking-clay black-soil plains. This enabled the proponent to design an irrigation scheme that was compatible with the regional conservation strategy to avoid significant adverse effects on biodiversity.

Furthermore, government involvement can be at the regional level through defining sustainability strategies that establish a framework for future resource development. The Canterbury Water Management Strategy is an example of this approach. Refer Appendix 2.

4.2 Reducing Time Periods for Approvals

In order to reduce time periods for project approvals without compromising community and environmental standards there needs to be community engagement and environmental assessments undertaken in advance of proposals. The undertaking of strategic environmental assessments by the WA Government of major industrial estates prior to specific proposals is key way for government involvement to facilitate environmentally sound development that has been exposed to public scrutiny and reduce the time period for project approvals.

The Oakajee Industrial Estate (in Section 1.2 above) is a good example where time was saved for the assessment of the Geraldton Steel Plant proposal. The SEA identified a potential problem for wastewater disposal over limestone with karstic cavities. It was possible for hydrogeological studies to be undertaken by State Government to identify suitable areas for liquid waste disposal. These studies took two years to complete but were completed in advance of any specific industrial proposals at Oakajee thereby reducing the time for the project approval process.

4.3 Management of Cumulative Effects

An area that is difficult to address in the project approval and regulatory processes is the management of cumulative effects. Governments can play a constructive role in addressing these issues. Approaches include:

- modelling of cumulative effects to facilitate the assessment of impacts of development proposals, e.g. the lake Benmore example in Section 3.2.1 above;
- monitoring and management for the combined effects of uses of a common resource, e.g. management of salinization of the Woolston-Heathcote aquifer in Section 3.2.1 above;

- the generation of regional sustainability strategies that provide a framework for future development proposals, e.g. the Canterbury Water Management Strategy in Section 1.3 above; and
- providing statutory backing for land use rehabilitation, e.g. the Penrith lakes Scheme in section 3.2.3.

4.4 Facilitation of Community Engagement by Government

For contentious projects government facilitation of community engagement can provide a mechanism for resolution of conflict. Formal project approval processes which invite public submissions can readily become adversarial.

Examples are provided in Section 5.1 below of community engagement processes facilitated by government which led to the development of alternatives to proponents' initial proposals, i.e. Orari Dam and Hurunui Water Project. The alternatives developed through government facilitated community engagement were acceptable to the community and avoided the contentious issues of community and environmental concern.

4.5 Generation of Solution Packages to Manage Effects

For many environmental issues the most effective measures can involve a suite of integrated actions by multiple parties, rather than just the mitigation measures of proponents of new developments. As part of the preparation of Zone Implementation Programmes for the Canterbury Water Management Strategy, Zone Committees developed "solutions packages" for addressing some of the more complex environmental issues.

One example was in the Hinds Catchment. Regional government organised economic analysis and water quality modelling in relation to the costs of on-farm mitigation measures for reducing water quality impacts and the use of managed aquifer recharge to offset nitrate concentrations in groundwater that had reached unacceptable levels.[16]

Achieving "good management practice" for farms throughout the catchment would lead to an estimated nitrate concentration in shallow groundwater of about 14 mgN/L. More advanced levels of mitigation would be needed to achieve the target of 6.9 mgN/L. Advanced Mitigation Level 1 would reduce modelled nitrate levels to 9.5 mgN/L with an estimated cost of $116/ha (loss in net profit after tax) for a "typical" farm. Advanced Mitigation Level 3 would be needed to achieve the water quality target but would cost $776/ha (loss in net profit after tax) where farm profits were estimated to be $835/ha. However, if a managed aquifer recharge scheme was part of the package the water quality target could be met with the additional cost above Advanced Mitigation Level 1 estimated to be $16/ha. The solution package recommended was a combination of the farm scale Advanced Mitigation Level 1 and the catchment scale managed aquifer recharge.

4.6 Changing Role of Government in Sustainable Development

Environmental impact legislation was designed for the role of government as a regulator of the adverse environmental effects of development activities. However, there are significant limitations of the environmental assessment processes in addressing many of these issues. Furthermore, the

[16] The information on this example is drawn from Section 14.1.4.2 Costs of Water Quality Management, in Jenkins (2018) Water Management in New Zealand's Canterbury Region: A Sustainability Framework, Springer Nature, Dordrecht.

concept of sustainable development has evolved with more appropriate tools for managing resources at or beyond their sustainability limits. While government still has a regulatory role, it also has a role as a facilitator of sustainability strategies. In addition, there are public good infrastructure elements for effects management and mitigation. Any public good infrastructure needs to be coordinated and integrated with private sector infrastructure. Funding mechanisms are needed for this infrastructure and an agency responsible for its implementation.

There is a proactive component to government's role in sustainable development. It would be appropriate for the legislative and institutional framework to reflect this changing role. The example has been developed for New Zealand[17] but the same concept could be applied in Australia and other jurisdictions. Figure 1 sets out a revised planning and authorisation framework to address the changing role of government and the evolving concepts of sustainable development. This comprises:

- Water framework legislation that establishes the range of sustainable development goals for water resources in New Zealand (similar to the EU Water Framework Directive but also providing the basis for addressing the UN Sustainable Development Goals for water);
- The authority through the water framework legislation to develop a national water strategy and regional strategies (so that the Canterbury Water Management Strategy has a statutory basis);
- The provision for strategic assessments to evaluate the environmental, social, cultural and economic outcomes of programmes associated with a regional strategy (i.e. broader than a strategic environmental assessment and similar to the sustainability appraisal approach of the CWMS);
- Regulatory legislation, an updated Resource Management Act, would be retained as the means of managing applicants' proposals for development;
- The regulatory instruments under the RMA (i.e. the National Policy Statements, National Environmental Standards and Regulations at the national level; and, Regional Policy Statements, Regional Plans and Resource Consents at the regional level) would be retained;
- Proactive legislation, an updated Local Government Act (LGA), would be needed as a means of enabling local authority contribution to sustainable water management;
- Regional and zone implementation programmes would have a statutory basis under the updated LGA: the regulatory elements would be incorporated into regional plans while the government actions would be channelled to a project authorisation process for funding and implementation under the updated LGA.

The provision for strategic assessments can also be made available to applicants' proposals. The resource consent process for evaluating proposals creates uncertainty and delay for applicants at the time of high investment risk exposure and limited flexibility to incorporate changes to meet environmental and other sustainability requirements. It is preferable to define environmental and other sustainability design requirements prior to the formulation of applicants' proposals so that they can be incorporated into the proposal design concepts.

[17] The content is drawn from the pre-publication version of Section 14.1.3.3 in Jenkins (2018) Water Management in New Zealand's Canterbury Region: A Sustainability Framework, Springer Nature, Dordrecht.

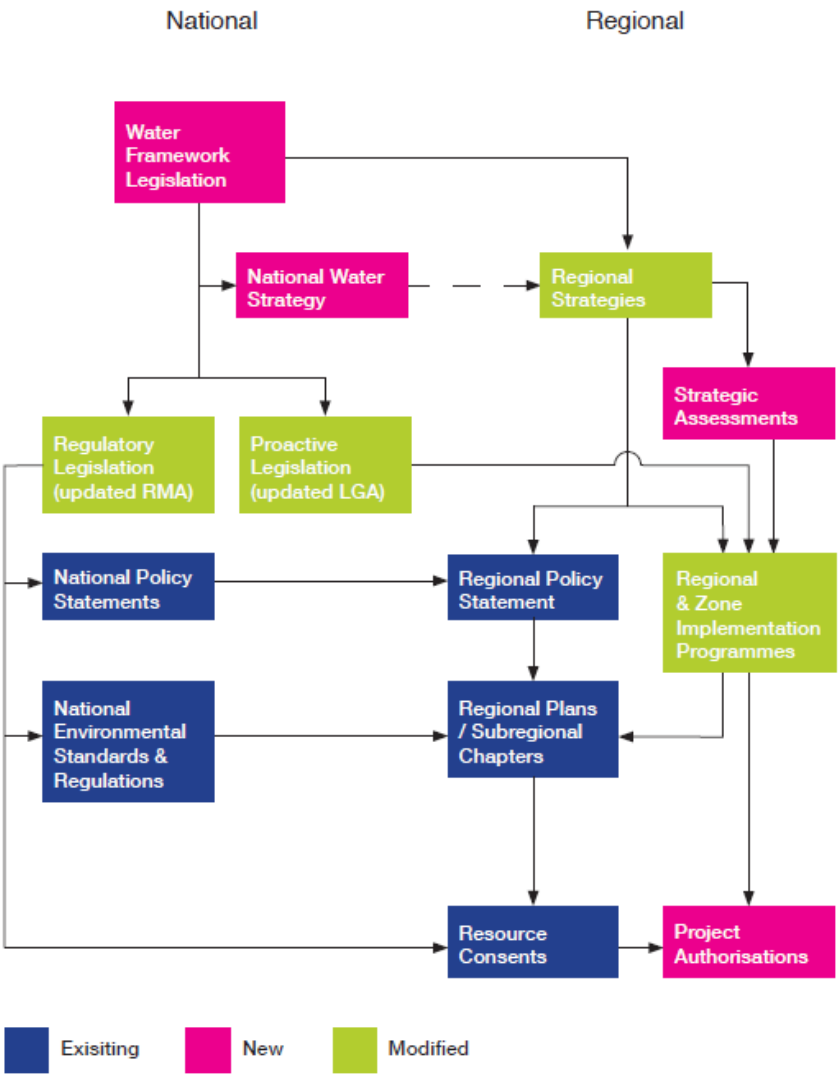

Fig. 1 Planning and Project Authorisation Framework

Figure 2 shows a proposed process where regional strategies are in place and an applicant's feasibility study can be subject to a strategic assessment in relation to the desired results of the regional strategy. The outputs of the strategic assessment are the environmental and other sustainability requirements that the development proposal is expected to achieve. Rather than a full assessment of environmental effects there is a report on strategic compliance and impact mitigation. There is then a compliance check to determine if the environmental and other sustainability requirements are met.[18] Where these are met a decision to proceed can be made.

[18] This is similar to the Californian two-tiered assessment and Arizona requirements for demonstrating sustainability and consistency with the groundwater management plan.

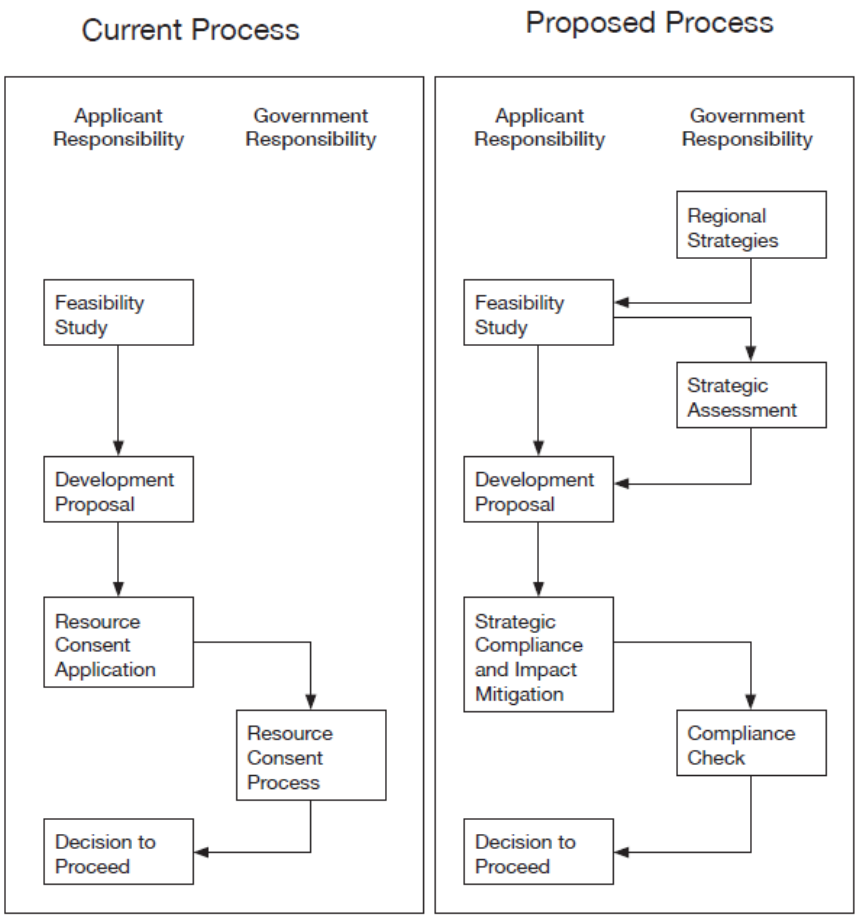

Fig. 2 Comparison of Current Process and Proposed Process incorporating Strategic Assessment

5. Effective Community Engagement

Decision making in controversial projects can be problematic. For decisions involving multiple stakeholders with different values, technical analysis while essential is not sufficient to determine how different interests can be reconciled. Furthermore, formal processes for public consultation in relation to contentious projects rarely achieve reconciliation between proponents and affected parties. Indeed, there is a tendency for these processes to be adversarial. Alternative approaches to designing collaborative decision making processes, which directly involve the range of stakeholders, include collective choice arrangements of Ostrom[19] and deliberative democracy described by Dryzek.[20] Examples of effective community engagement using collaborative governance approaches are described below:

(i) Developing sustainable alternatives to applicant's proposals
(ii) Developing a strategy for future development in advance of proposals
(iii) The variations in community engagement moving from strategy development through implementation to operations

[19] Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action.* Cambridge University Press, New York.
[20] Dryzek J (2010) Foundations and Frontiers of Deliberative Governance. Oxford University Press, Oxford.

(iv) The framework of matters to be considered in multi-stakeholder decision making processes.

5.1 Alternatives to Applicant's Proposals

Two examples are from water management in Canterbury, New Zealand, where collaborative approaches were used to generate alternatives when there were concerns about the sustainability of the applicant's initial proposals.

The first example is the proposal for a dam on the Orari River. Community concerns led to the regional council (the assessment authority in Canterbury) initiating a community planning process for the Orari Catchment. The community process led the applicant to consider an alternative approach to damming the river to create a storage. The alternative was taking water during high flows from the Rangitata River (an adjacent major river where low flows were already fully allocated) and diverting this water to an off-river storage. This alternative was well received by community interests. More details of this example are contained in Appendix 3.

The second example is the Hurunui Water Project proposal where the initial proposal involved putting control gates to manage the level of Lake Sumner (a lake of high conservation value) and a dam on the South Branch of the Hurunui River (with high values for fishing and whitewater rafting). Multiple legal processes involving the applicant and affected parties led to a stalemate. A moratorium was placed on consent applications.

Under the Canterbury Water Management Strategy, a collaborative governance body, the Hurunui-Waiau Zone Committee had been formed (refer Section 5.3 below). Assessment processes were set aside to see if a collaborative process could achieve an agreed water storage strategy. This led to the selection of a tributary storage on the Waitohi River with a diversion from the Hurunui River. With lake conservation values maintained and fishing and whitewater rafting values retained, this alternative received few submissions in the subsequent assessment process. More details of the process are contained in Appendix 3.

5.2 Developing a Strategy for Future Development in Advance of Proposals

The concept of the Canterbury Water Management Strategy was to define what form of water resource development would be sustainable in advance of proponents submitting proposals for assessment. The decision-making process for developing the Canterbury Water Management Strategy was designed to be collaborative with stakeholder and community engagement. The steps in the community engagement process defined the decision-making process. The approach was based on Ostrom's self-managed community approach and in particular her concept of "collective choice arrangements".[21]

A Steering Group under the auspices of the Canterbury Mayoral Forum (an informal group comprising all the mayors of the district and city councils and the chair of the regional council, and their chief executives) provided oversight of the process. The Steering Group comprised

[21] Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action.* Cambridge University Press, New York.

representatives of local and regional government, tangata whenua[22], as well as farming, environmental, industry and recreational interests.

The community engagement process had activities based on seven milestones. Milestone 1 was the announcement of the process. Milestone 2 was the definition of the process based on working with stakeholders to specify an effective and credible process for integrated water management in contrast to the more limited scope of water availability and provision of storage that had been the focus of earlier work.

Milestone 3 was identifying through community engagement the range of uses and benefits associated with water for all stakeholders to be incorporated in a water management strategy. Milestone 4 was the public reporting of the uses and benefits and making them available for public scrutiny and comment.

Milestone 5 was defining strategies that could address the range of community uses and benefits of water. This was conducted in a series of workshops by the multi-stakeholder Steering Group. Milestone 6 was public engagement on the strategic options. All households in Canterbury received a booklet describing the options. This was followed by a submission and public hearing process. A sustainability appraisal of the strategic options was undertaken by the multi-stakeholder Steering Group.

Milestone 7 was the documentation of the strategic framework[23] and the commencement of its implementation. The process delivered an agreed strategic framework for water management which had the acceptance of multiple stakeholders who had widely different views at the commencement of the process.

More details of this example are set out in Appendix 4.

5.3 Variations in Community Engagement from Strategy Development to Operations

The most appropriate form of community engagement can vary depending on the stage of resource development from strategy formulation through implementation of operations. Variations can occur in terms of (a) their dominant spatial scale, (b) their governance arrangements, (c) the approach to decision making, and, (d) the means of funding.

The case of water management in Canterbury is discussed below. The spatial scale reduced from the Canterbury region for strategy formulation, to Zones (multiple catchments and associated groundwater basins) for developing implementation programmes, and, tributary catchments and irrigation districts for operations. There was increasing formality in governance arrangements from informal organisation but structured engagement for strategy formulation, to formal Zone Committees for developing implementation programmes, and, even greater formality at the operational scale with farmer collectives required to meet specific outcomes.

In terms of decision making and funding, for strategy formulation decisions were made by consensus of the multi-stakeholder Steering Group while funding of the process was by the regional council. For development of implementation programmes, the funding and staffing was by the regional

[22] Tangata whenua means 'people of the land' in Maori and refers to people with a traditional connection to the land.

[23] Canterbury Water (2009) Canterbury Water Management Strategy Strategic Framework. Environment Canterbury, Christchurch

council while the Zone Committees were advisory with statutory components drafted by the regional council and then subject to statutory hearing processes. The operational outcomes for land and water management were defined by statutory plans but the means of achieving the outcomes could be determined by water users. For operations, the funding implications were borne by water users (for land and water management requirements) and the regional council (for biodiversity and recreational requirements).

Further details of this example are provided in Appendix 5.

5.4 Framework of Matters in Multi-stakeholder Decision Making Processes[24]

Collaborative governance approaches involve multi-stakeholder decision processes. There is not a "one-size-fits-all" formula; rather there is a framework of matters to be considered. This includes the context involving the process design, the linkage to decision making, the identification of issues, stakeholder identification, facilitation back-up and funding. It includes framing of the process in terms of group composition, goals and agenda. Inputs comprise stakeholder preparations, agreed rules and procedures, mechanisms to address power gaps between participants, and, capacity building of stakeholders. Dialogue during the process needs established communication channels, facilitation and rapporteuring leading to decision making and closure of issues. Outputs need to be documented and facilitate the implementation of action plans; the ongoing stakeholder processes need to have an impact on official decision making and continue to relate to non-participating stakeholders and the general public. Throughout the process there needs to be "metacommunication", i.e. time for reflection, reassessment and feedback (Hemmati 2002).[25]

One example that is consistent with this framework was the Canterbury Regional Council's Living Streams Programme (Jenkins 2009).[26] The programme was designed to improve land management practices that have an impact on water quality and to maintain the health of waterways. The programme comprised three stages of (1) investigation: collecting information about the catchment and stream health in order to identify the issues that need to be addressed in a catchment report; (2) involvement: the results of the investigations are presented to landowners and community groups to review the catchment report, consider options and develop an action plan to meet community goals for the catchment; and (3) implementation: council officers working alongside landowners to encourage the voluntary undertaking of improvements, to monitor water quality changes, to inform the community of progress, and to reassess the actions required. Funding support was available through an Environmental Enhancement Fund (Environment Canterbury 2009).[27]

Table 1 sets out how the design of the Living Streams Programme relates to the framework of the multi-stakeholder decision processes. An example of the outcome of the Living Streams Programme was the Pahau catchment where there was a significant reduction in pollutant load from the voluntary actions leading to improved water quality.

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[24] This section is drawn from Chapter 12 of the submission draft of Jenkins, B. (2018) *Water management in New Zealand's Canterbury Region: A sustainability framework.* Dordrecht, The Netherlands: Springer. https://doi.org/10.1007/978-94-024-1213-0

[25] Hemmati M (2002) Multi-stakeholder Processes for Governance and Sustainability. Earthscan, London

[26] Jenkins BR (2009) Best Practice Partnerships at the Local Government Level for the Environment. Paper presented at the Community Boards' Conference, Christchurch, 19-21 March 2009

[27] Environment Canterbury (2009) Living Streams: A guide to restoring rural waterways. Environment Canterbury, Christchurch

Table 1 Living Streams Programme as a Multi-stakeholder Decision Process

Multi-stakeholder Decision Process Framework[28]	Living Streams Programme[29]
Context	
Process design	Three stages: investigation, involvement and implementation
Linkage to decision making	Voluntary actions by landowners on their land
Identification of issues	Through catchment report preparation
Stakeholder identification	Land owners and community groups in catchments with degraded water quality
Facilitation backup	Resource care officers at regional council
Funding	Landowner contribution with support from Environment Enhancement Fund
Framing	
Group composition	All landowners and communities in catchment
Goals	Improve land use practice affecting water quality
Agenda	Set by catchment report
Inputs	
Stakeholder preparations	Involve landowners and community groups in action plan development
Agreed rules and procedures	Approach defined in Living Streams handbook
Power gaps	All participants treated equally
Capacity building	Extension role of resource care officers
Dialogue	
Communication channels	Community meetings
Facilitation	Facilitation by resource care officers
Rapporteuring	Documentation of agreements in action plan
Decision making	Voluntary agreements with landowners
Closure	Monitoring of water quality improvements
Outputs	
Documentation	Catchment report and action plan
Action plan implementation	Agreed actions undertaken
Ongoing stakeholder processes	Community meetings and on-site facilitation
Impact on official decision making	Programme part of regional council activities
Throughout the process	
Meta-communication	Monitoring of effects of implementation and reassessment of actions required
Non-participating interests	Reports public, open invitation to participate
Relating to general public	Reports public, meetings open to public

[28] Adapted from (Hemmati 2002)
[29] Extracted from (Jenkins 2009a)

Appendix 1

The role of EIA in greenhouse gas mitigation

International Association of Impact Assessment Conference 2017 (ID 88), Montreal

Bryan Jenkins

Abstract

The role of EIA in Western Australia and New Zealand in addressing greenhouse gas emissions is compared. Since the mid-1990s, Western Australia has had provisions requiring greenhouse gas emissions to be considered in EIA. With major mining and energy projects, limiting greenhouse gas emissions has been a priority. EIA has played a significant role in managing greenhouse gas emissions through improved design, carbon sequestration and forestry offsets. New Zealand's resource management legislation was amended in 2004 to introduce climate change considerations but greenhouse gas emissions were specifically excluded from the EIA process managed by regional government: they were to be addressed by a National Environmental Standard which has not been promulgated. Agricultural emissions are the dominant source in New Zealand with the greatest increases coming from dairy farm conversions often from forested land. With no EIA provisions this has led to increased emissions and loss of sinks.

Western Australian Situation

Australian Government Greenhouse Gas Policy

The Australian Government has set its 2030 target of reducing emissions to 26-28% below 2005 levels. In 2017, the Australian Government is commencing another review of its climate change policies including the opportunities and challenges of reducing greenhouse gas emissions (Australian Government, 2017). In 2011 legislation was passed to create a carbon pricing mechanism (a cap-and-trade emissions trading scheme). This commenced in July 2012 but was repealed in July 2014 and the "Direct Action Plan" implemented with the centre piece of the Emissions Reduction Fund which is to purchase emissions reduction through a reverse auction.[30]

Initial Commonwealth policies were primarily voluntary, such as the National Greenhouse Challenge Program for industry aimed at capturing the potential for reductions in emissions through voluntary and cost-neutral steps. Australia gained concessions from the international community at the 1997 Kyoto Conference by arguing that unlike most other developed countries, Australia's economy was heavily reliant on energy-intensive industries. Australia was allowed an 8% increase in 1990 emissions by 2010.

In 2013, Australia's greenhouse gas emissions were calculated under the UNFCCC accounting framework to be 538 $MtCO_2$-e (million tonnes of carbon dioxide equivalent). This is a 1.2% increase compared with 1990 levels of 532 $MtCO_2$-e. Energy is the main contributor (76%) which increased

[30] The Emission Reduction Fund operates in three parts: (1) *crediting*, where businesses identify emission reductions that go beyond business-as-usual activities; (2) *purchasing*, where the Clean Energy Regulator runs auctions to select lowest cost abatement among registered projects, and (3) *safeguard mechanism*, to ensure emission reductions paid for by the Emissions Reduction Fund are not displaced by business-as-usual levels elsewhere in the economy. Through the first two reverse auctions the government has contracted to purchase 92.9 $MtCO_2$-e of abatement (Commonwealth of Australia, 2015). Its cost effectiveness is a matter of debate (Ward, 2015)

40% in greenhouse gas emissions since 1990. This was primarily offset by the land use, land use change and forestry sector which shifted from contributing 19% of emissions in 1990 to providing a sink for 4% of emissions in 2013: principally due to land clearance controls. Australia has the highest per capita emissions of any OECD country. It was 23.3 tCO_2-e per person in 2013 which is a 25% decline from 31.2 tCO_2-e per person in 1990. While GDP grew 103% between 1990 and 2013, the emissions intensity of the economy was halved from 0.71 $kgCO_2$-e per dollar in 1990 to 0.35 $kgCO_2$-e per dollar in 2013 (Commonwealth of Australia, 2015).

Environmental Impact Assessment in Western Australia

With a heavy emphasis on resources and energy development, primarily for export, Western Australia is a major contributor of greenhouse gas emissions. The top ten emitters from mining and hydrocarbon projects emit an estimated 34.7 $MtCO_2$-e (6.5% of Australia's total emissions) (Chapple, 2012).

Environmental impact assessment (EIA) for new developments is primarily the responsibility of state governments. The Western Australian Environmental Protection Authority has recommended conditions aimed at reducing greenhouse gas emissions on development proposals using EIA since the late 1990s. Proponents of projects with significant greenhouse gas emissions are to (1) identify all greenhouse gas emission sources and calculate emissions in accordance with the National Greenhouse and Energy Reporting Act; (2) demonstrate that the proposal is designed and will be operated in a manner which maximises energy efficiency and minimises greenhouse gas emissions as far as practicable; and, (3) provide an analysis of greenhouse gas intensity (i.e. quantity of CO_2-e generated per tonne of product produced) and consider published benchmarked best practice for equivalent plants and equipment (Environmental Protection Authority, 2015).

In the initial form of the EPA policy (Environmental Protection Authority, 1998) the benchmarking was also against Australia's target from the 1997 Kyoto Climate Change Conference. The 108% target represents a 25% reduction from "business-as-usual" predictions of greenhouse gas emissions for the year 2010 (which was 143% of 1990 levels). The expectation was that companies producing greenhouse gas emissions would go beyond a "no regrets" approach.[31] Examples of the outcomes from the EIA processes for major mining and hydrocarbon projects are presented below:

- The Murrin Murrin Nickel-Cobalt project expansion was to increase to 250% of its original capacity. It involved the mining of a new ore body and transporting the ore to an expanded plant. The commitment in relation to reducing greenhouse gas emissions from the EIA process were: (1) the adoption of a recent development of nickel laterite processing – a no regrets measure achieving an estimated 10-25% reduction in greenhouse gas intensity; (2) indirect heating (rather than direct steam injection into the process); (3) rail transport of ore (rather than truck); and, (4) tree farming to offset emissions. This was estimated to achieve a 16-30% greenhouse gas emission reduction compared to 1990 business-as-usual (Environmental Protection Authority, 1999).
- The Gas to Synthetic Hydrocarbons Plant on Burrup Peninsula was to process natural gas to produce 1,240 tonnes per day of synthetic crude oil which can then be processed into specialty products such as lubricants and diesel fuel. The commitments in relation to reducing greenhouse gases from the EIA process were: (1) a 50% improvement in thermal

[31] "No regrets" approaches are greenhouse gas emission reduction measures that have positive net benefits because they generate direct or indirect benefits that are large enough to offset the costs of implementing the measures (IPCC, 2001) "Beyond no regrets" measures have net costs.

efficiency compared to the pilot plant, (2) improved life cycle analysis of products, e.g. sulphur-free diesel fuel, and, (3) use of process steam for the state government's water desalination plant eliminating the need for an alternative fuel source (Environmental Protection Authority, 2000).

- The Gorgon Gas Development Expansion on Barrow Island Nature Reserve was to expand liquefied natural gas production from 10 million tonnes per annum (MTPA) to 15 MTPA by the addition of a third gas processing train. The commitments to reduce greenhouse gas emissions from the EIA process were: (1) sequestering carbon dioxide emissions into a saline aquifer 2,000m beneath the ground, (2) LNG technology improvement, (3) use of sub-sea production system, and, (4) improved waste heat recovery. This reduced the greenhouse gas emission intensity from 0.89 tCO_2-e per tonne of LNG from the 1998 concept design to 0.35 tCO_2-e per tonne of LNG (Environmental Protection Authority, 2009).

New Zealand Situation

New Zealand Government Greenhouse Gas Policy

The New Zealand Government's provisional gross emission target for 2030 is 30% below 2005 emissions (a target which is only 10% below 1990 levels). The Emissions Trading Scheme is the principal means that is currently in place to generate greenhouse gas reductions. The Climate Change Response Act 2002 put in place the legal framework to enable New Zealand to meet its international obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol.

An amendment in 2008 established a greenhouse gas emissions trading scheme (ETS). The ETS was to cover all gases and all industries but with different entry times. Compliance for industries would require the surrender of a New Zealand emission unit or an international unit for each tonne of greenhouse gas emissions. New Zealand emission units were to be capped in number and were to be allocated by grandparenting (gifting) or auctioning. Trade-exposed industries were to receive a 90% free allocation of units to 2018 with phasing out by 2030. Forest owners with pre-1990 forests were to receive a fixed one-off free allocation of units. Post-1989 afforestation would earn credits while units would have to be purchased for deforestation.

With a change of government there were amendments to the ETS in2009 (the Climate Change Response (Moderated Emissions Trading) Amendment Act 2009) and 2012 (the Climate Change Response (Emissions Trading and Other Matters) Amendment Act 2012). The current scheme has removed the cap on New Zealand emissions and has permitted unlimited importation of international units. Compliance now only requires one unit for every 2 tonnes of emissions. Trade-exposed, emission-intensive industries get free allocations based on production. The phase out of free allocations is now over a longer time period. There are no free allocations to industry that can pass on costs to consumers. There is an indefinite deferral of including agricultural emissions in the ETS.

The outcome of the ETS has led to significant deforestation before the commencement of the commitment period in 2008 (Ministry for the Environment, 2016b). The purchase of international units of dubious efficacy has removed the carbon price signal to motivate reduction in greenhouse gas emissions (Sustainability Council of New Zealand, 2015). The free allocations to industry transfer the costs of compliance to the taxpayer (Sustainability Council of New Zealand, 2015). The uncapped system with low carbon cost has led to growth in current and projected emissions. In 2014, gross

emissions were calculated as 81.1 Mt CO_2-e which is an increase of 23% above 1990 levels (Ministry for the Environment, 2016a).

Agriculture is the main contributor to gross emissions (49%), the highest for an OECD nation. Energy is also a significant contributor (40%); with a high percentage of hydro generation this is low for an OECD country. In 1990, forestry was a significant sink for New Zealand (28.9 $MtCO_2$-e) reducing net emissions to 36.9 $MtCO_2$-e. With deforestation and harvesting, there has been a reduction in forestry as a sink (to 24.4 $MtCO_2$-e in 2014) so that net emissions are 56.7 $MtCO_2$-e in 2014, a 54% increase since 1990. Per capita emissions are lower than Australia at 17.2 tCO_2-e per person in 2014 and have decreased by 7% since 1990. The emission intensity of the economy has decreased from 0.82 $kgCO_2$-e/$GDP in 1990 to 0.55 $kgCO_2$-e/$GDP in 2013. Between 1990 and 2014 agricultural emissions increased 15% mainly due to a 95% increase in the dairy herd (increasing methane emissions) and a more than five-fold increase in the application of nitrogen-containing fertiliser (increasing nitrous oxide emissions). In the energy sector the major change was the increase in road transportation greenhouse gas emissions (72%) (Ministry for the Environment, 2016a).

Assessment of Environmental Effects in New Zealand

New Zealand's principal legislation relating to natural resources management is the Resource Management Act 1991 (RMA). The legislation includes the provisions for the assessment of environmental effects of new projects which are primarily the role of regional councils. The RMA was amended in 2004 to incorporate renewable energy and climate change provisions. However, the 2004 amendments **preclude** regional councils from having regard to the effects of greenhouse gas emissions on climate change (RMA Sections 70A and 104E). The intention was that climate change would be addressed as a national issue through a National Environmental Standard (NES): no NES has been promulgated.

There is no policy instrument to address agricultural emissions as they are not part of the ETS and greenhouse gas emissions from land use intensification, such as dairy conversions and forest clearance, is not subject to EIA evaluation under the RMA. The agricultural sector is projected to provide 77% of the growth in emissions (Sustainability Council of New Zealand, 2015).

Dairying is a significant component of the New Zealand economy. In 2013, dairy exports were $13.7 billion which was 29% of New Zealand exports and 40% of the world export market. Milk solids production increased from 599 million kg in 1990/1 to 1,890 million kg in 2014/5. The greatest growth has been in the Canterbury region increasing from 6 million kg of milk solids in 1984/5 to 376 million kg of milk solids in 2014/5 (Livestock Improvement Corporation and Dairy NZ, 2015). Conversion to dairy farms from dryland sheep and beef farms and deforestation leads to land use intensification with irrigation and increased fertiliser application. This increases methane emissions from ruminant animals and nitrous oxide emissions from nitrogen fertiliser.

Furthermore, net removals from forestry have decreased due to increased harvesting of plantation forests as a larger proportion of the estate reaches harvest age, and forest being converted to pasture. Between 2003 and 2012, New Zealand's planted forest has declined from 1,827,333 ha to 1,719,501 ha (6% decline), while in Canterbury the planted forest has declined from 122,773 ha to 110,055 ha (10% decline) (Ministry of Agriculture and Forestry, 2004) (Ministry for Primary Industries, 2013). Deforestation intention surveys indicate 86% conversion from forestry to dairying (Manly, 2013).

The greenhouse gas emissions from dairy farms are variable: Ledgard examined 26 dairy farms in Rotorua and estimated an average of 9,067 $kgCO_2$-e per ha with a range from 4,504 to 12,198

$kgCO_2$-e per ha (Ledgard, Judge, Smeaton, & Boyes, 2010). Smeaton modelled a base dairy farm model of 9,300 $kgCO_2$-e per ha compared to a sheep and beef farm of 3,400 $kgCO_2$-e per ha (Smeaton, Cox, Kerr, & Dynes, 2011). Thus, for a conversion from a sheep and beef farm to a dairy farm would increase greenhouse gas emissions by about 5,900 $kgCO_2$-e per ha.

Mason and Ledgard are developing a calculator for greenhouse sinks from radiata pine plantation on the basis that one hectare of pine plantation can absorb 11,800 $kgCO_2$-e, allowing for harvesting (Mason & Ledgard, 2013). Thus, for a dairy conversion from a plantation forest the net increase in greenhouse gases is about 20,100 $kgCO_2$-e per ha.

In terms of greenhouse gas mitigation the most promising options for nitrous oxide have been identified as: nitrogen inhibitors that keep nitrogen in the less mobile ammonium form for longer, the use of herd shelters that can minimize the deposition of urine patches at high-risk times of the year, and, replacing nitrogen fertilizer inputs to boost pasture production with inputs of maize or cereal silage to reduce the amount of nitrogen ingested and excreted (De Klein, Monaghan, Ledgard, & Shepherd, 2010). Potential methane reduction strategies are only in the research stages. These are selective breeding of low emission sheep and cattle, changing animal feed, and biotechnologies that target microbes in the rumen that produce methane (Parliamentary Commissioner for the Environment, 2016). There are avenues for offsets through farm forestry and hydro generation as a component of irrigation storage (Jenkins, 2015).

For management of greenhouse gas emissions in New Zealand there would be value in incorporating consideration of such emissions in the assessment of environmental effects for proposals like dairy conversions.

Concluding Comments

Management of greenhouse gases requires effective government policy. In the absence of mitigation measures greenhouse gas emissions can be expected to continue to grow. The use of EIA in Western Australia has been shown to provide a mechanism for evaluating new mining and hydrocarbon development proposals leading the adoption of “beyond no regrets” measures. However, the preclusion of the consideration of greenhouse gas emissions in EIA in New Zealand has allowed land use intensification and deforestation to occur significantly increasing greenhouse gas emissions. EIA can be an effective component in the policy mix to address greenhouse gas mitigation.

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Appendix 2

Changing Water Management Practice in Canterbury to Address Sustainability Limits

Jenkins BR (2018) Paper presented SIWI World Water Week 2018: Water, Ecosystems and Human Development, 26-31 August 2018, Stockholm.

Abstract

Irrigation expansion led to sustainability limits being reached for water availability and cumulative effects of land-use intensification. Increasing water availability through storage was proposed. There was strong community opposition to impacts of storage and further intensification. Effects-based institutional arrangements proved inadequate to address these issues.

The regional council introduced a strategic approach based on nested adaptive systems and collaborative governance. A regional water strategy was developed through a multi-stakeholder steering group under the Canterbury Mayoral Forum and with extensive community engagement. Zone Committees were established to develop Zone Implementation Programmes. Farmer collectives are being established for operational delivery of water management targets. Farmers develop farm management plans to meet property-level outcomes which are independently audited.

Strategy investigations demonstrated that focusing on new development would not achieve sustainable development, rather existing users also had to improve. Water-use efficiency improvements were more cost effective than new storage. Furthermore, different forms of storage, such as managed aquifer recharge, were identified to avoid adverse effects on mainstems of alpine rivers. Proactive measures were needed to address water quality degradation, biodiversity loss, Māori involvement, and ecological restoration.

A systems perspective and a governance change from regulatory to collaborative has improved water management. However, it also identified issues concerning affordability of proactive measures, equity in allocation, and need for a public infrastructure agency. Uneven implementation of measures has led to some groups withdrawing from the collaborative process.

Keywords

Nested adaptive systems; Collaborative governance; Sustainability strategies; Water resource management; Community outcomes.

Introduction

The paper sets out the changes in water management in Canterbury to address sustainability limits. The first section provides the background to the expansion of irrigation to facilitate the conversion of dryland farms to dairying. This resulted in reaching water availability limits and cumulative effects of land use intensification. The initial response of proposing storage on alpine rivers led to significant community opposition. The legalistic nature of effects-based legislation for project approvals and the inability to deal with cumulative effects exacerbated the polarisation of views but allowed further development.

The second section describes the theoretical framework used to develop a new water management paradigm for Canterbury based on nested adaptive systems and collaborative governance. The third section describes the development of the Canterbury Water Management Strategy as well as its implementation and operational delivery. It also describes the changes in water management achieved so far. The final section looks at further changes needed to achieve sustainable water management and some emerging issues.

The questions addressed by the paper are: What are the issues leading to failure of water management in Canterbury? What was the basis for defining a new paradigm for water management? How was the new paradigm applied in Canterbury? What were the resulting changes in water management? Were the changes sufficient to achieve sustainable water management? What more needs to be done to achieve sustainability?

Background to reaching sustainability limits

Significance of water in Canterbury

Water is a vital component of both the economy and the ecology of the Canterbury region. Although only 12% of the area of New Zealand, the Canterbury region allocates 58% of the country's water, has 64% of its irrigated land, generates 24% of the country's power through hydroelectricity, has 65% of the nation's hydro storage, and provides a high-quality drinking water supply to its major city, Christchurch, without treatment. Moreover, water sustains braided rivers of international significance, high country and coastal lakes, the groundwater basins of the Canterbury plains, as well as groundwater-fed lowland streams and wetlands (Jenkins, 2007a; Dark et al., 2017).

Canterbury is in the rain shadow of the Southern Alps on the relatively dry east coast of New Zealand's South Island (Figure 1). It is the region with the greatest evapotranspiration deficit (322 mm/a) and is dependent on irrigation for increasing agricultural productivity. The aquatic ecology is sensitive to flow variability, low flows, and water quality making it vulnerable to water extraction for irrigation and water quality impairment from land use intensification (Jenkins, 2018a).

Irrigation expansion

Canterbury has seen a more than sixty-fold increase in dairy production from 6 million kilograms of milk solids (kgms) in 1984-5 to 385 million kgms in 2015-6 (LIC and DairyNZ, 2016). This is from the conversion of dryland farms to irrigated dairy farms adding significantly to irrigated area in the region. Census data estimated irrigated area in Canterbury at 287,168 ha in 2002, while detailed mapping indicated 507,468 ha in 2015 (Brown, 2016).

Figure 1: Location of Canterbury Region

Sustainability limits

Expansion of irrigation resulted in cumulative effects on river flows from abstraction (primarily associated with lower flows and reduced variability), groundwater drawdown and reduced flow in groundwater-fed streams, and water quality effects from land use intensification (primarily nutrients, bacterial contamination, and sediments). The flow reductions and longer duration of low flows led to decreased freshwater habitat and reduced connectivity to other habitats. Reduced flow variability lowered streams' ability to flush fine particles and algae, thereby diminishing the quality of the freshwater habitat. Reduced flood flows decreased river bed mobility required to maintain the braided character of Canterbury's alpine rivers (Biggs et al., 2008).

Surface water availability is at sustainability limits as out-of-stream withdrawals are restricted at low flows (Environment Canterbury, 2016). Groundwater availability is at sustainability limits as the effective allocation exceeds the allocation limit for nearly all groundwater zones (Jenkins, 2018a). Nitrate and bacterial contamination of groundwater from land use intensification is increasing and exceeds drinking water standards in some locations (Hansen and Abraham, 2009). Nutrient enrichment, algal blooms, faecal contamination, siltation and nitrate toxicity are approaching, and in

many cases exceeding, water quality standards in groundwater-fed lowland streams and lower reaches of foothill and alpine rivers (Stevenson et al., 2010; Robinson and Bolton-Ritchie, 2014).

Initial strategy for storage on alpine rivers

The initial strategic response to increased water demand and limitations on water availability was for increased storage on Canterbury's alpine rivers. The dominant form of irrigation supply is the direct withdrawal from rivers. A regional supply/demand analysis (Morgan et al., 2002) indicated that allocable flow from surface and groundwater was unable to meet existing demand (as at 2001) let alone future demand (refer Table 1) with the current means of abstraction.

Table 1: Regional water supply/demand analysis for Canterbury (Morgan et al., 2002).

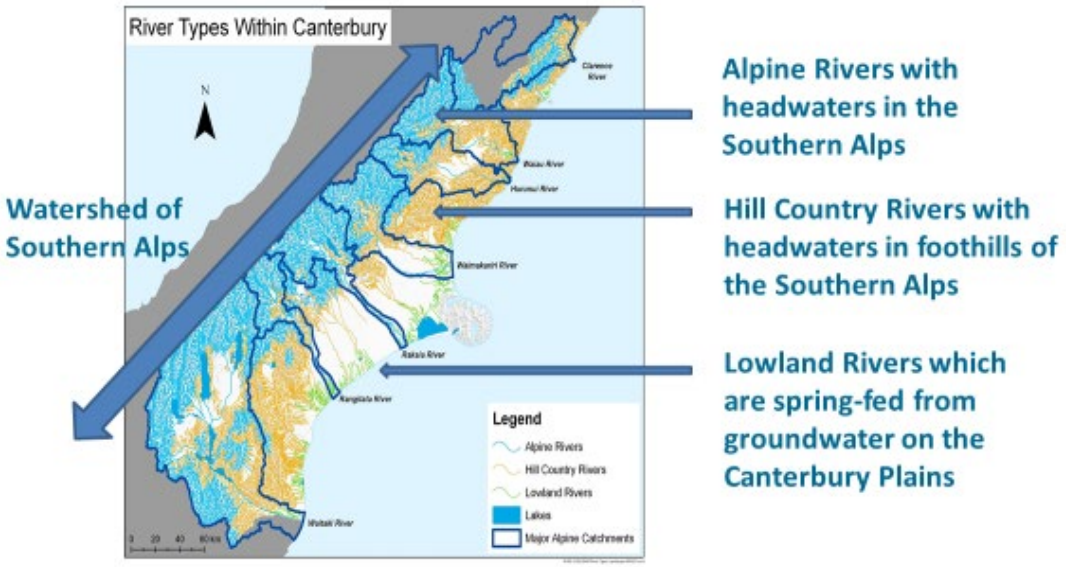
Weekly Minimum Flow Supply (m^3/s)		**Annual Average Flow Supply (m^3/s)**	
Allocable from surface water		Allocable from surface water	
- under mean annual low flow	175	- average annual flow	594
Allocable from groundwater	16	Allocable from groundwater	16
Total Allocable Flow	191	Total Allocable Flow	610
Current (2001) Peak Weekly Demand	290	Current Annual Average Demand	81
Future (2021) Peak Weekly Demand	569	Future Annual Average Demand	229

For run-of-river irrigation, the critical parameter of weekly minimum flow (175 m^3/s – the 7-Day mean annual low flow) plus the allocable flow from groundwater (16 m^3/s) provides a total allocable flow of 191 m^3/s. This is less than the current (2001) peak weekly demand at that time of 290 m^3/s; and, well below the forecast future (2021) peak weekly demand of 569 m^3/s. However, based on annual average flow, there is the potential for 594 m^3/s to be allocated from surface water. Added to a groundwater allocation of 16 m^3/s, this could provide 610 m^3/s that is greater than the current (2001) annual average demand (81 m^3/s) and the forecast future (2021) annual average demand (229 m^3/s). Therefore, on an annual basis there is the potential to meet future water demand, however, it would require storage (Morgan et al., 2002).

A second stage of strategic investigations was undertaken to identify major storages (Aqualinc Research Limited, 2008). The focus was on storages on alpine rivers of Canterbury which carry 88% of the annual average flow (refer Figure 2). The hill country and lowland rivers have much lower flows and are under greater pressure from extraction.

A third stage of strategic investigations was a multi-stakeholder evaluation of possible storage options. In addition to comparing the storage options, the multi-stakeholder group recommended that before storage decisions were made, rigorous scientific and public consideration was needed of: (1) the impacts of land use intensification and its effects on water quality; (2) mitigation and management systems of water quality; and (3) methods for maintaining or improving flow variability and low flows in major rivers (Whitehouse et al., 2008)

Figure 2: River types in Canterbury (Source: Environment Canterbury)



Concerns associated with storage and further intensification

While storage on the main stems of alpine rivers may provide a means of addressing water availability, there are significant sustainability issues with this approach. This includes: (1) impacts on the naturalness of high country areas in relation to landscape, ecosystem habitat and amenity values; (2) reduction in flood flows which decreases the number of braids in braided rivers; (3) sediment entrapment which reduces the bedload downstream of dams and the sediment supply to the coast leading to increased coastal erosion; (4) reduction in flushing flows resulting in greater frequency and persistence of algal blooms; (5) temperature stratification in reservoirs which inhibits oxygen diffusion to the hypolimnion resulting in deoxygenation of bottom waters; (6) nutrient retention in reservoirs from land use intensification leading to occurrence of aquatic weeds; and (7) reduced instream recreational opportunities for white-water sports and fishing (Jenkins, 2007b).

Water quality impairment from land use intensification was a major concern. Monitoring at the time indicated 11% of sampled wells in the Central Canterbury Plains exceeded the maximum acceptable value for drinking water of 11.3 mg/L (Hanson and Abraham, 2009). Regional modelling of nitrate leaching to groundwater predicted increases above drinking water quality in many locations if all potentially irrigable land was irrigated using existing land use practices (Bidwell et al. 2009). Further intensification with current land use practices would also exacerbate water quality contamination of surface water (Canterbury Water 2013, 2014a, 2014b, 2014c, 2015).

Effects-based institutional arrangements inadequate

The main law for natural resource management in New Zealand is the Resource Management Act (New Zealand Government, 1991). It is effects-based legislation and focuses on the environmental effects of activities rather than the activities themselves. The Act establishes an Environment Court with powers to review the technical merit of decisions. This makes resource management a highly legalistic process and led to an adversarial style of decision making. A major process under the Act is

the environmental impact assessment of new development proposals. This provides a capacity to address project-specific effects, but the Act was not designed to manage the cumulative effects of multiple activities.

The purpose of the Act is "sustainable management" – allowing the use of resources subject to environmental bottom lines. However, there is no elaboration in the Act on how decision makers can apply this purpose. Interpretations by the courts have defined an "overall broad judgement" of balancing resource use and environmental effects (Skelton and Memon, 2002). This concept of overall broad judgement has led to the Environment Court and hearing commissioners to approve further intensification in Canterbury despite limitations on water availability or degraded water quality (Environment Court, 2005; Milne et al., 2010).

Theoretical framework underpinning the new paradigm

Paradigm shift in Canterbury water management

There was recognition of the need for a paradigm shift in water management in Canterbury. The focus on storage as a means of addressing water availability issues did not have widespread community support. The effects-based legislation and legal processes focussed on individual projects were inadequate to deal the cumulative effects of multiple projects and exacerbated community conflict. There was need for an approach which (1) addressed the sustainability limits of water availability, (2) managed the cumulative effects of water extraction and land use intensification, and (3) facilitated consideration of multiple issues at multiple scales.

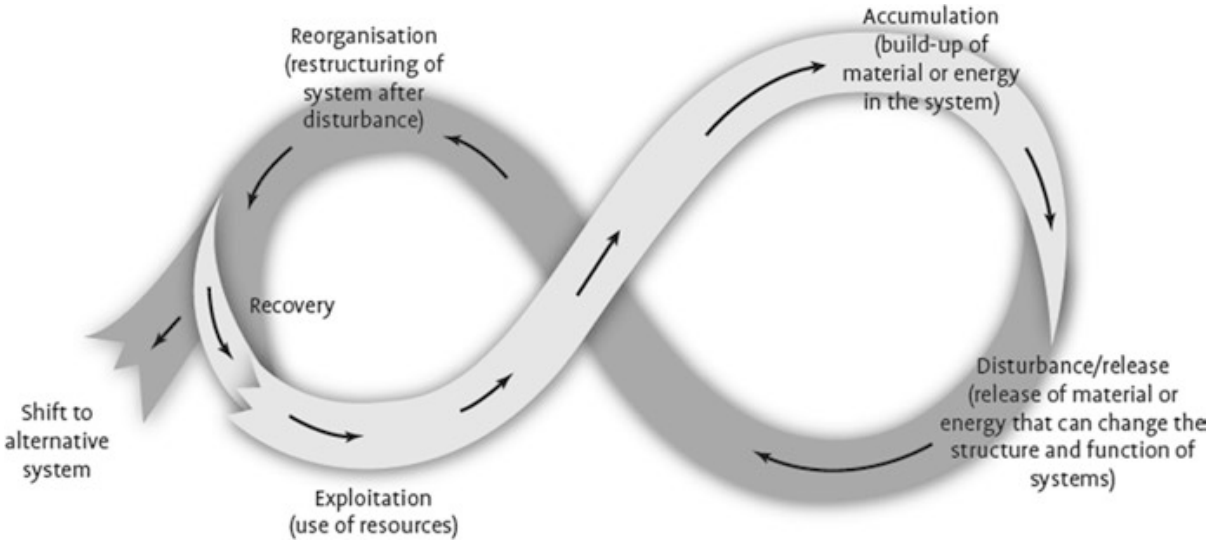
The regional council introduced a strategic approach based on nested adaptive systems and collaborative governance. A regional water strategy was developed through a multi-stakeholder steering group under the Canterbury Mayoral Forum and with extensive community engagement. The alternative paradigm was developed based on the concept of nested adaptive systems developed by Gunderson and Holling (2002) to define failure pathways, and sustainability strategies derived from Chapin and his colleagues (2009). The collaborative governance approach for the development of the regional strategy is based on Ostrom's (1990) institutional design for governing the commons.

Nested adaptive systems

Gunderson and Holling (2002) define an "adaptive cycle" to describe how an ecological or human system can be sustained in obtaining resources for its ongoing survival, and, in accommodating disturbance to the system and restructuring. This provides the basis for defining sustainability with respect to the maintenance of the relationships in adaptive cycles across different time and spatial scales. There are four phases in the adaptive cycle: (1) exploitation – the use or harvesting of resources, (2) accumulation – the storage of material or energy in the system, (3) release – disturbance of the system, and (4) reorganisation – restructuring of the system after disturbance.

The four phases of the adaptive cycle can be depicted as a Lissajous figure (Figure 3). The cycle is sustainable if the resources needed to maintain the system continue to be available and if the system can recover after disturbance. There is a critical point in the reorganisation phase whether the system continues (recovery) or whether the system fails and shifts to an alternative system.

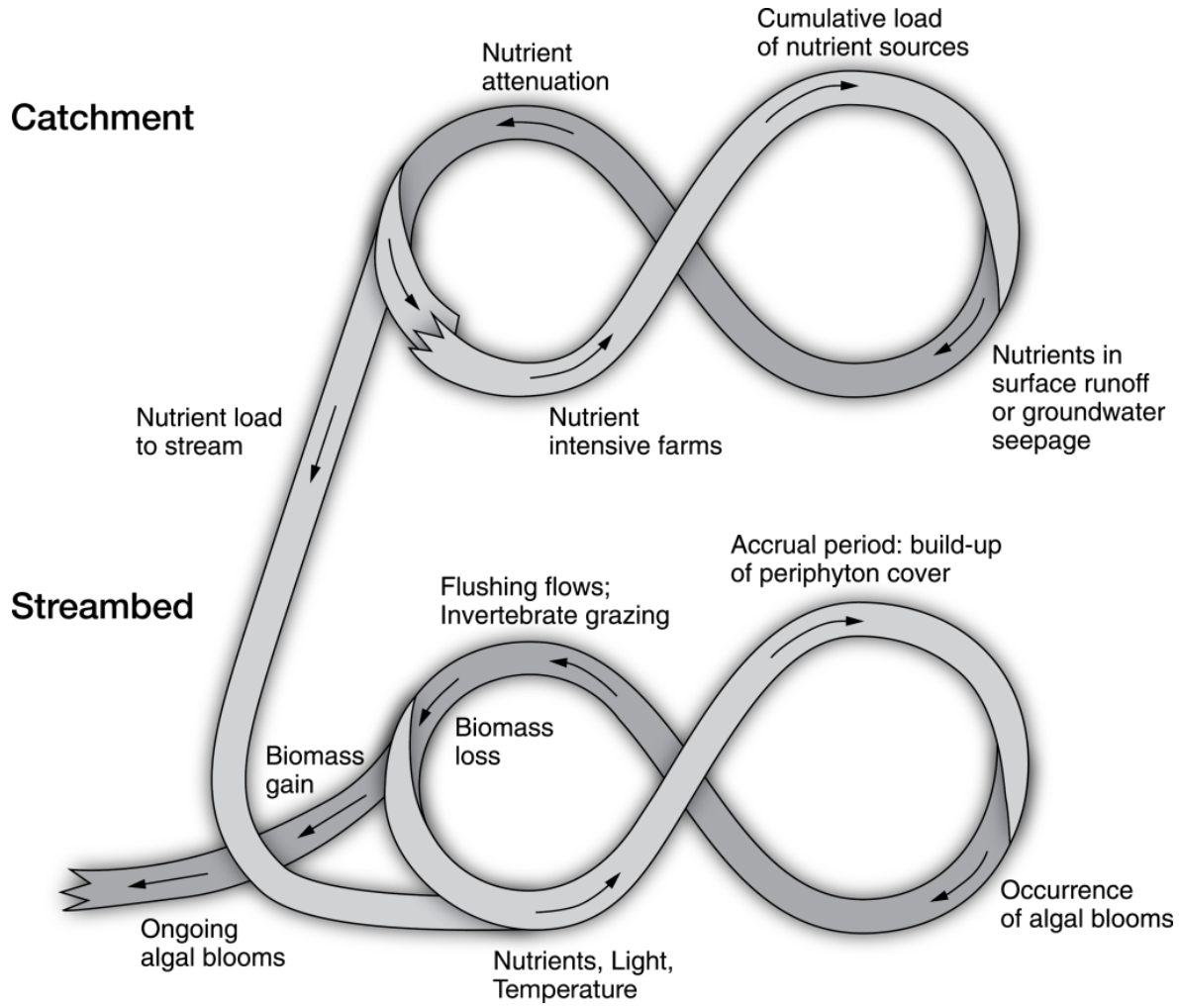
Figure 3: The adaptive cycle (Adapted from Gunderson and Holling, 2002).



For sustainable water management in Canterbury at least four spatial scales need to be considered: (1) the regional level, to address water availability and land use intensification; (2) the catchment level, to address sustainable levels of water use, cumulative impacts of intensification, and reliability of supply for irrigation; (3) the subcatchment level, to address environmental flow requirements in river reaches, and, ecosystem management of streams and their riparian margins; and (4) the property level, to address land use practices that influence water quantity and water quality (Jenkins, 2007a).

The adaptive cycles associated with different levels can be linked – what is referred to as "nested adaptive systems". For example, for algal blooms in rivers there is a need to consider the catchment scale and the streambed scale. At the catchment scale the key phases are: (1) exploitation – the nutrient loss from land use intensification, (2) accumulation – the catchment load from the accumulation of nutrient loses from properties in the catchment, (3) release – the nutrient concentration in surface runoff and seepage to groundwater, (4) reorganisation – any attenuation of nutrients before flow reaches the streambed. At the scale of the streambed, the key phases for periphyton growth are: (1) exploitation – the nutrient levels, light availability and temperature for periphyton growth; (2) accumulation – the accrual period for biomass accumulation; (3) release – the occurrence of algal blooms, and (4) reorganisation – either recovery through the occurrence of freshes to dislodge periphyton from the river bed or invertebrate grazing to reduce periphyton biomass, or, ongoing degradation with algal blooms. The linkage between scales and the nesting of adaptive cycles is shown in Figure 4 (Jenkins, 2018a).

Figure 4: Nested adaptive cycles for algal blooms in rivers (Jenkins, 2018a)



Collaborative governance

The approach adopted in Canterbury was based on Ostrom's (1990) collaborative governance arrangements for the management of common pool resources.[32] Ostrom compared the following institutional designs for managing resources, such as water, at sustainability limits: (1) Centralised control where government determines how the resource will be allocated and managed; (2) Privatisation where access to the resource is governed by private property rights; and (3) Self-governing communities where there is community determination of resource management requirements.

In her analysis, she found that long-term survival of common pool resources (CPR) was associated with self-governing communities with the following characteristics: (1) clearly defined boundaries; (2) congruence between appropriation and provision rules with local conditions; (3) collective choice arrangements; (4) active monitoring of resource condition and member behaviour; (5) graduated sanctions for violating operational rules; (6) conflict resolution mechanisms; (7) rights of resource users to devise their own institutions; and (8) nested enterprises for larger systems.

[32] Common pool resources are natural or man-made resource systems that are *non-excludable*, i.e. it is difficult to exclude potential beneficiaries from accessing the resource, and *subtractable*, i.e. use by one user subtracts from the available resource and reduces the availability of the resource to others.

The Canterbury approach

The development of the Canterbury Water Management Strategy (CWMS)

The fourth stage of the strategic investigations was the development of the Canterbury Water Management Strategy (CWMS) based on Gunderson and Holling's concept of nested adaptive systems for managing natural resources and Ostrom's self-managed community approach to governing common pool resources (Canterbury Water, 2009).

A key element of the CWMS was the collective choice arrangements, including: (1) stakeholder and community engagement in developing strategic options and the fundamental principles of the strategy; (2) definition of strategic options by a multi-stakeholder group; (3) region-wide consultation with the community on option preferences; (4) strategic investigations of likely outcomes to inform the engagement process; (5) sustainability appraisal of options in relation to economic, social, cultural and environmental criteria; and (6) the agreement on a strategic approach to water management, environmental restoration, infrastructure requirements and governance arrangements (Jenkins and Henley, 2014).

CWMS development was under the auspices of the Canterbury Mayoral Forum (the mayors of city and district councils in the Canterbury region, the chair of the regional council, and their chief executives) to achieve political collaboration. Oversight of the process was by a multi-stakeholder Steering Group (a 16-person group with backgrounds in irrigation, industry, conservation, fishing, recreation, Māori, and, local, regional and central government).

Community engagement included the following processes: (1) open meetings across the region on the uses and benefits of water leading to the definition of a Vision and Fundamental Principles for a strategy and ten community outcomes for water;[33] (2) facilitated workshops for the development of strategic options by the multi-stakeholder Steering Group and public consultation on those options;[34] (3) facilitated workshops for the sustainability of strategic options to define the components of a draft strategy;[35] and (4) public hearings and stakeholder review of the draft strategy leading to the preparation of the final Strategic Framework document (Canterbury Water, 2009).

Outcomes of the strategy

Some of the key outcomes of the strategy comparison were that: (1) the status quo of reliance of the Resource Management Act was not sustainable, (2) a strategy based on mainstem storage on alpine rivers could meet economic but not environmental criteria, (3) a strategy based on environmental enhancement could meet environmental but not economic criteria; and (4) to achieve sustainability it was not sufficient to assess new developments, there was also a need to improve water use efficiency and land use practices (in relation to their effects on water quality) of existing users.

As a result of the CWMS, there was a transformation in water management in Canterbury from a polarisation of community views concerning water storage and land use intensification, to

[33] The definition of Fundamental Principles and Community Outcomes for water was enabled by the use of "Open Strategy" – a web-based tool for collaborative decision making based on a Projects/Results/Uses/Benefits framework (Driver, 2014).

[34] The formulation of strategic options was facilitated by using "Strategic Choice" (Friend and Hickling, 2005; Jenkins, 2018b). This approach was selected from the experience of decision making in environments where interorganisational collaboration was essential to successful service delivery (Midgley, 2000).

[35] The evaluation of options was undertaken using "Sustainability Appraisal" (Jenkins et al., 2014)

widespread support for integrated water management that addressed ten community priority issues for water: ecosystem health, natural character, *kaitiakitanga* (Māori stewardship), drinking water, recreation, water use efficiency, irrigated land area, energy, economy, and environmental limits.

The focus of water management shifted from water availability and storage to identification of community values and the wide range of uses and benefits associated with water. The acceptance of the strategy appeared to be related the ability to be involved, and, to influence strategy development and the outcome of the process.

Collaborative processes increased the level of constructive dialogue between the different stakeholder interests compared to the legalistic, adversarial style of statutory processes. New concepts for water availability were brought into the process, such as diversions to tributary storage and managed aquifer recharge, rather than mainstem storage (Jenkins, 2013) and water use efficiency (Jenkins, 2012). It also led to addressing land use practices to reduce water quality impairment (FAR et al. 2015) and for proactive approaches to biodiversity enhancement (Environment Canterbury, 2016).

Implementation of the strategy

The implementation of the CWMS Strategic Framework document (Canterbury Water 2009) contained the three key elements[36]: (1) proposed immediate actions, e.g. the establishment of nutrient limits; (2) investigations to deal with important areas of uncertainty, e.g. setting of catchment load limits; and (3) definition of the way that deferred choices would be made, i.e. the continuation of the collaborative approach, at the local level through ten Zone Water Management Committees, and at the regional level through a Regional Water Management Committee, with the development of zone and regional implementation programmes.

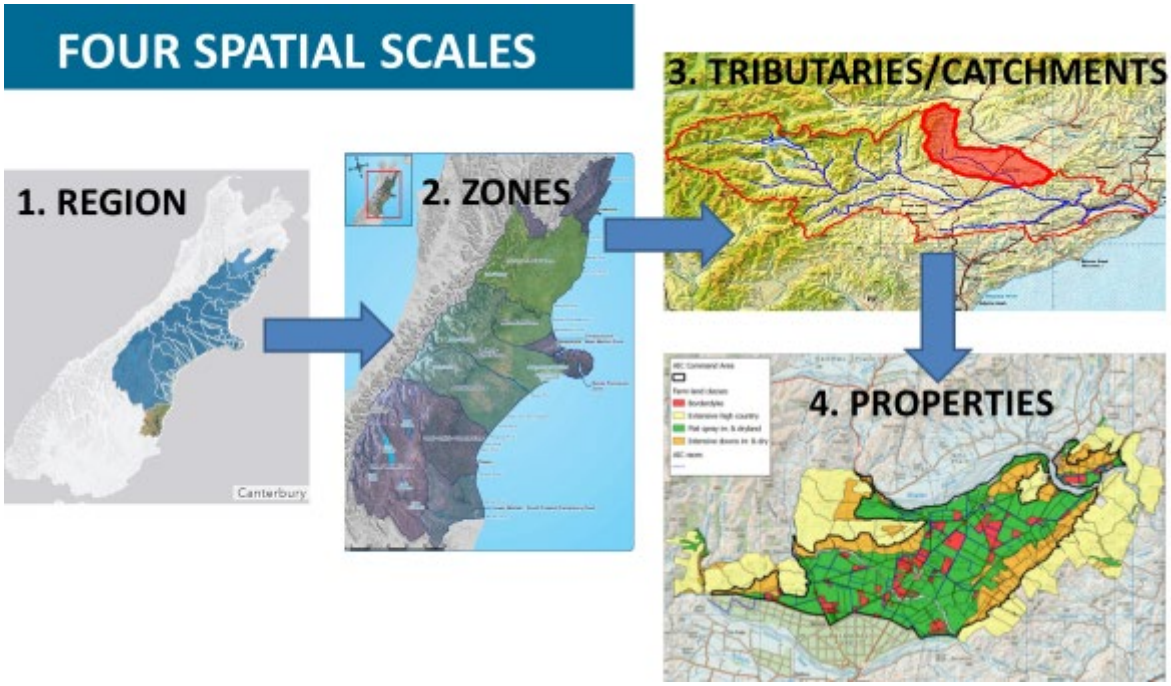
Zone Committees brought together the authorities for water (regional council) and land use (city and district councils), *rūnanga* (Māori tribal groupings), and six to seven appointed members of the community. The purpose of Zone Committees is to facilitate community engagement in developing Zone Implementation Programmes (ZIPs) to give effect to the CWMS targets at the Zone level. The ten zones are shown in Figure 5. The Regional Committee has regional council, city/district council, Māori, community members and a representative from each Zone Committee. It is a nested rather than hierarchical arrangement: Zone Committees deal with catchment issues and the Regional Committee with regional issues.

There has been progressive establishment of Zone Committees throughout the region. ZIPs were prepared within 12 to 18 months of committees being established (e.g. Canterbury Water, 2011). More recently several Zone Committees have prepared Addenda to their ZIPs focussed on "solution packages" for more difficult issues (primarily water quality issues for lakes) that had not been addressed in detail in the original ZIPs. The Regional Committee has produced a Regional Implementation Programme (Canterbury Water, 2012).

Like the CWMS, the recommended programmes of the committees in the ZIPs were non-statutory. Statutory backing of the CWMS was provided by a new Regional Policy Statement (Environment Canterbury, 2013). Statutory backing for the implementation programmes by the Canterbury Land and Water Regional Plan (Environment Canterbury, 2015) which is a nested document with a regional component for region-wide rules and ten zone components for rules within each zone.

[36] Note that these elements are the elements of a "commitment package" following the approach of "Strategic Choice" (Friend and Hickling 2005).

Figure 5: Four spatial scales for implementing the Canterbury Water Management Strategy (Jenkins, 2017).



Operational delivery

In relation to water availability, there has been a shift in emphasis from storage on alpine rivers to water use efficiency in order to reduce water requirements for further irrigation. This has mainly been achieved through conversion of border dyke (flood) irrigation to spray irrigation (Brown, 2016), and through replacing water distribution systems in irrigation schemes from open channels to piped distribution (e.g. Ashburton Lyndhurst Irrigation Scheme).

New approaches to storage that avoided the effects of dams on the main stems of alpine rivers, were identified not only to improve water availability but also to enhance reliability of supply. Off-river storage of high river flows and diversions to storage on tributaries were alternative approaches to access alpine river water. Another option is groundwater recharge (i.e. managed aquifer recharge for storage and recovery). Improved reliability was achieved by on-farm storage and storage within irrigation schemes.

With respect to the effects of land use intensification on water quality there has been the introduction of changes in land management practices to reduce nutrients in surface runoff and seepage to groundwater. Water quality criteria for receiving waters have been defined and catchment nutrient load limits to achieve these criteria have been estimated (e.g. Norton, 2013).

Collaborative processes have led to agreements to raise minimum flows and the reduce allocations at low flows, e.g. Pareora River (Environment Canterbury, 2010). These agreed changes do not always achieve the full extent of desirable environmental flows because the changes come at a cost to existing users. Collaborative outcomes have recognised the need for allocations at higher flows that involve on-farm storage for their effective use. There has also been the recognition that existing users need time to adjust.

For the target area of biodiversity, implementation programmes have identified priority areas for rehabilitation. Projects are being funded through the Immediate Steps Biodiversity and Enhancement Programme (Environment Canterbury, 2016) based on community recommendations and their contribution to the goals of the Canterbury Biodiversity Strategy (Environment Canterbury, 2008).

Progress is also being made in kaitiakitanga. There is Māori representation at the governance level on zone committees and the regional committee. A relationship agreement – Tuia – has been signed between the regional council and rūnanga for on-going collaboration in water management (Ngā Papatipu Rūnanga[37] and Environment Canterbury, 2012). The Mahaanui Iwi Management Plan has been prepared which includes *ngā paetae* (objectives), *ngā take* (issues of significance) and policies to guide freshwater management in a manner consistent with *Ngāi Tahu*[38] cultural values and significance. Work on a restoration programme for Te Waihora/Lake Ellesmere – Whakaora Te Waihora – a lake of cultural significance to Ngāi Tahu is progressing (Ngāi Tahu and Environment Canterbury, 2016)

Operational management has introduced a new alternative to the Resource Management Act approach of the regulator setting consent conditions that are inspected for compliance by the regulator, to an approach reflecting Ostrom's principles. The primary governance element is the establishment of farmer collectives based on irrigation districts, tributary catchments (or stream allocation zones), or farm enterprises, with a secondary governance element as the farm property (refer Figure 5). It is a nested system based on the achievement of water quality targets in rivers and lakes which lead to catchment contaminant load limits defined as a collective responsibility; and with each farmer developing a farm environment plan to specify on-farm actions to meet farm management objectives and targets within the environmental management system for the collective. Each farmer is responsible for monitoring the actions undertaken and achievement of the targets which are audited by a certified farm plan auditor.[39]

Further changes needed and emerging issues

Further changes needed

While there have been significant positive changes towards sustainable water management a sustainability analysis identified shortcomings in the level of intervention in the implementation programmes and issues to be adequately addressed (Jenkins, 2018a).

The solution packages for water quality management devised by Zone Committees will improve water

[37] Ngā Papatipu Rūnanga refers to those Rūnanga recognised under the Te Rūnanga o Ngāi Tahu Act 1996 whose traditional territories are within the greater Canterbury region.

[38] Ngāi Tahu is the Māori tribe whose *rohe* (tribal territory) includes the Canterbury region.

[39] This is based on the concept of audited self-management where (1) The environmental performance requirements were set by the regulator but industry was able to determine how to meet the requirements; (2) Industry was required to have an environmental management system (EMS) with independent certification (by either the regulator or independent certifier); (3) Industry was required to undertake measurements to demonstrate environmental performance requirements had been met with the measurements audited by an independent auditor (either the regulator or an independent auditor); and (4) The results of the measurements were to be publicly reported (Jenkins 1996).

quality compared to current management. However, they will not achieve desired community water quality outcomes. This is recognized by Zone Committees with their proposals being seen as a significant first step and that there is a need for further improvement over time.

Improved water use efficiency was a critical element of the CWMS. Improved water use efficiency of existing users increases water availability without requiring further abstraction and reduces surface runoff and groundwater leakage contaminated by land use intensification. It was recognised that defining efficiency is not straightforward, so development of benchmarks and reporting on them was a target of the CWMS implementation scheduled for 2015. This has not been achieved.

New Zealand's response to climate change has been minimal with emissions continuing to increase. The agricultural sector is the largest contributing sector representing 47% of total emissions and is projected to provide 77% of the growth in emissions (Sustainability Council of New Zealand, 2015). However, there are actions that could be taken through mitigation measures and offsets. Furthermore, better use could be made of economic instruments and environmental impact assessment procedures to manage emissions. While the consequences of climate change have been identified, there is not an adaptation or emission reduction strategy in place.

A key element of the acceptance of the CWMS was the commitment to targets that reflected the range of uses and benefits that the community sought from water management in Canterbury. However there has been differential progress in the implementation of these targets. In particular, the 2015 targets for recreational and amenity opportunities, ecosystem health and biodiversity, and economic externalities have not been met, leading to the withdrawal of some stakeholders from the collaborative process.

Affordability of management measures has been a constraint on the ability to implement elements of the CWMS. Affordability has been an issue in finding viable storage schemes to improve water availability, for improvements in land management practices to reduce water quality contamination, and for communities in water treatment for addressing the risks of waterborne diseases.

There is a related issue of the need for funding mechanisms for water infrastructure. While the private sector can address commercial water resources development, it is not well placed to address lake or river restoration, climate change strategies, managed aquifer recharge, biodiversity projects and catchment-wide public good infrastructure. There is no central government agency for water management, and regional councils have been established with a regulatory function.

The paradigm in the current legislation (Resource Management Act) is based on the management of effects of development within environmental limits. However, with pollutant load uncertainties, inaccuracies in load estimation, natural variability, multiple variables affecting outcomes, contributions from legacy issues as well as current activities, lag times in effects, unresolved cause-effect relationships and difficulties in enforcing limits that lack certainty, managing to limits for project effects to achieve sustainable outcomes is not enough. Furthermore, for cumulative effects there are multiple geographical scales, many potential points of intervention and multiple actors. A statutory framework involving a systems-based approach, like nested adaptive cycles, is needed to achieve sustainable outcomes.

While the Resource Management Act provides a framework for regulation of activities and mitigation of adverse effects, it does not provide a framework for proactive measures to achieve sustainable outcomes. The Act is not well suited to managing water scarcity and the cumulative effects of diffuse sources from land use intensification. This could be achieved by putting in place Water Framework legislation similar to the European Union approach of the Water Framework

Directive (European Commission, 2000) and the requirement for regional sustainability strategies. The concepts of sustainable development have evolved since the framing of the Resource Management Act in 1991. The role of government has also changed. It is appropriate to change the legislative and institutional framework to reflect these evolving concepts of sustainability and the changing role of government from environmental regulator to facilitator of sustainable development.

Emerging issues

An emerging issue is the need for improved integration of surface water and groundwater interaction. With the high permeability of the sediments of the Canterbury Plains, streams can have gaining reaches (inflow with groundwater) and losing reaches (outflow to groundwater). The sustainability analysis identifies the importance of the effect of groundwater pumping on flows in surface waterways, the consideration of managed aquifer recharge as a form of storage, targeted recharge to maintain lowland stream flows, and spatial allocation of surface and ground water to enhance recharge.

Another emerging issue from the CWMS implementation to date is the importance of modelling to predict outcomes both scientific and financial from the decisions being made, and, the related issue of the data available to operate and verify the models. With the need to manage more efficiently and to tighter limits, predictive models and field measurement are essential. With increasing reliance on farm management plans and audited self-management foreshadowed in the CWMS and now being incorporated into plans and consents, the need for modelling and measurement will escalate.

A further emerging issue is equity in allocation. This is arising in relation to the allocation of nutrient capacity. One type of issue is the allocation between existing users. A second type is between existing and future users: for further land use intensification to occur, existing users have to reduce their cumulative nutrient contribution below the specified limit to create capacity (often referred to as “headroom”) for future intensification.

Conclusions

There has been a transformation in water management in Canterbury with the introduction of collaborative governance. At the strategic level there has been a shift from a focus upon water availability and storage, to integrated water management based on nested spatial scales of the region, zone, subcatchment and farm levels with targets across ten priority community issues. The approach has required innovative techniques of community engagement and decision making which have led to new approaches to address the region’s water management issues. There has also been a shift from effects-based management focussed on mitigating adverse effects of new development to proactive programmes of ecosystem and biodiversity enhancement. Different collaborative arrangements have been developed for the different stages for strategy development, implementation formulation, and on-the-ground delivery.

With water resource abstraction and the effects of intensification from water use at or beyond sustainability limits, reactive measures, such as limiting resource availability or the effects of resource use, are insufficient to achieve sustainable management. Rather there is a need for proactive measures (i.e. management interventions) to achieve sustainable outcomes.

The Implementation Programmes for the CWMS represent significant interventions to improve water management in the Canterbury region. However greater interventions in water quality are needed to meet the desired targets. Better measurement and management of water use efficiency is needed for

effective implementation of the strategy. With the projected consequences of climate change there is a need for a regional strategy for climate change adaptation and greenhouse gas mitigation. Shifting from proponent-led development to devising alternatives and interventions for improved sustainability outcomes highlights the issue of affordability and funding of the actions to be taken. There is a need for an agency with a mandate for environmental infrastructure and infrastructure coordination and an investment framework for funding proactive measures. Addressing the issues of differential progress of target implementation, empowerment of all water stakeholders, and re-engagement of environmental and recreational interests is needed to ensure the long-term viability of the collaborative process. There is also the need for water framework legislation which addresses sustainable development of water resources.

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Appendix 3

Jenkins, B.R. 2013. “The Development of Sustainable Alternatives to Applicants' Proposals Using Collaborative Approaches.” Hamilton, New Zealand: New Zealand Planning Institute Annual Conference 2013 (NZPI), 30 Apr-3 May 2013.

The Development of Sustainable Alternatives to Applicant's Proposals Using Collaborative Approaches

Bryan Jenkins[1]

[1] Waterways Centre for Freshwater Management, University of Canterbury and Lincoln University

Abstract

The purpose of the Resource Management Act is to achieve sustainable management. However, the development of alternatives is primarily the responsibility of applicants. In practice this usually leads to proposals that maximise the interests of applicants and result in adverse effects at the margins of acceptability. This paper describes the application of collaborative approaches to two controversial storage proposals in Canterbury – a dam on the Orari River and the Hurunui Water Project (a storage on the South Branch of the Hurunui River and control gates on Lake Sumner). Both processes led to the development of different alternatives which were superior in terms of sustainable management, lower impacts and greater community acceptance – respectively an off-river storage taking high flows from the Rangitata River, and, a series of storages on the Waitohi River, a tributary to the Hurunui.

The use of collaborative processes as an alternative to RMA processes to resolve issues was initially resisted by applicants. However, there has been a high level of acceptance of the value of collaboration after innovative alternatives were developed. Some of the key learning outcomes from this approach include: the value of collaborative engagement with affected communities outside of adversarial RMA processes; the improvements in alternative generation from collaboration if affected communities can meaningfully participate in decisions on alternative selection; and, the limitations of RMA processes in achieving sustainable management.

1. Introduction

The Resource Management Act was designed on the premise that people know best what it is that they are after in pursuing their well being[40]. Thus, the responsibility for defining proposals was left to proponents. The RMA was also designed on the basis of "effects management", i.e. that choices by applicants would be constrained by bottom lines.

This approach may be suited to circumstances where there is an abundance of resources. However, when resource use approaches sustainability limits, either in terms of resource availability or in terms of cumulative effects of resource use, then the actions of one user can harm all others. Indeed for a common pool resource (i.e. a resource that is readily accessible and difficult to exclude access to, and, is in limited supply so that resource use by one user diminishes the availability for others), allowing all users to act in their own self interest leads to degradation of the resource for all users.[41]

[40] Upton, S. (1995) Purpose and Principle in the Resource Management Act. *Waikato Law Review 1995 V 3,* pp17-55.

[41] Hardin, G., (1968) The Tragedy of the Commons. *Science 162,* pp1243-1248.

The work of Ostrom indicates that collaborative governance approaches provide institutional arrangements compatible with sustainable management of common pool resources.[42] This paper provides two examples from water management in Canterbury where collaborative approaches were used to consider alternatives when there were concerns about the sustainability of applicant's initial proposals. The first example is the proposal for a storage on the Orari River. Community concerns led to the regional council initiating a community planning process for the Orari catchment in partnership with the Landcare Trust. The second example is the Hurunui Water Project proposal which involved putting control gates to manage the level of Lake Sumner and a dam on the South Branch of the Hurunui River. RMA statutory processes were well advanced including a resource consent for the applicant's proposal and a Water Conservation Order to prevent damming the Hurunui and controlling Lake Sumner.

The paper provides a description of the two processes and the generation of alternatives that were superior in terms of sustainability, and a discussion of the key learning outcomes from these processes.

2. Orari River Dam

Rangitata South Irrigation Limited (RSIL) was formed in 1999 with the aim of bringing reliable irrigation water to the land between the Orari and Rangitata Rivers (Figure 1). RSIL's initial application was for 5.94 cumecs run-of-river withdrawal from the Rangitata River to irrigate 16,000ha. There was already concern about the existing level of withdrawals from the Rangitata. Also in 1999, Fish and Game NZ initiated a Water Conservation Order process for the Rangitata River.[43] After the run-of-river withdrawal was declined in 2004, RSIL proposed to dam the Orari River. This proposal met strong opposition from the Orari Catchment community leading to the formation of the Orari River Protection Group.

To address these concerns the regional council in partnership with the NZ Landcare Trust organised community meetings in Geraldine. Initial meetings were addressed by technical experts on the water resources of the Orari catchment and by spokespersons for different stakeholder interests. Over time the hostility of the meetings subsided, and constructive discussions commenced.

The community process led RSIL to consider an alternative approach to storage. This was taking of water during high flows on the Rangitata and diverting the water to an off-river storage. This alternative was well received by the community interests. From having 400 objections to the Orari Dam proposal, the new method of storage met virtually no opposition.

The community catchment group continued and developed the Orari River Catchment Management Strategy (Orari ICM Community Group, 2008)[44]. This has led to community involvement in a range of voluntary activities, such as pest and weed control, and, blue duck habitat protection. The Strategy has also been invaluable to the regional council in managing its activities.

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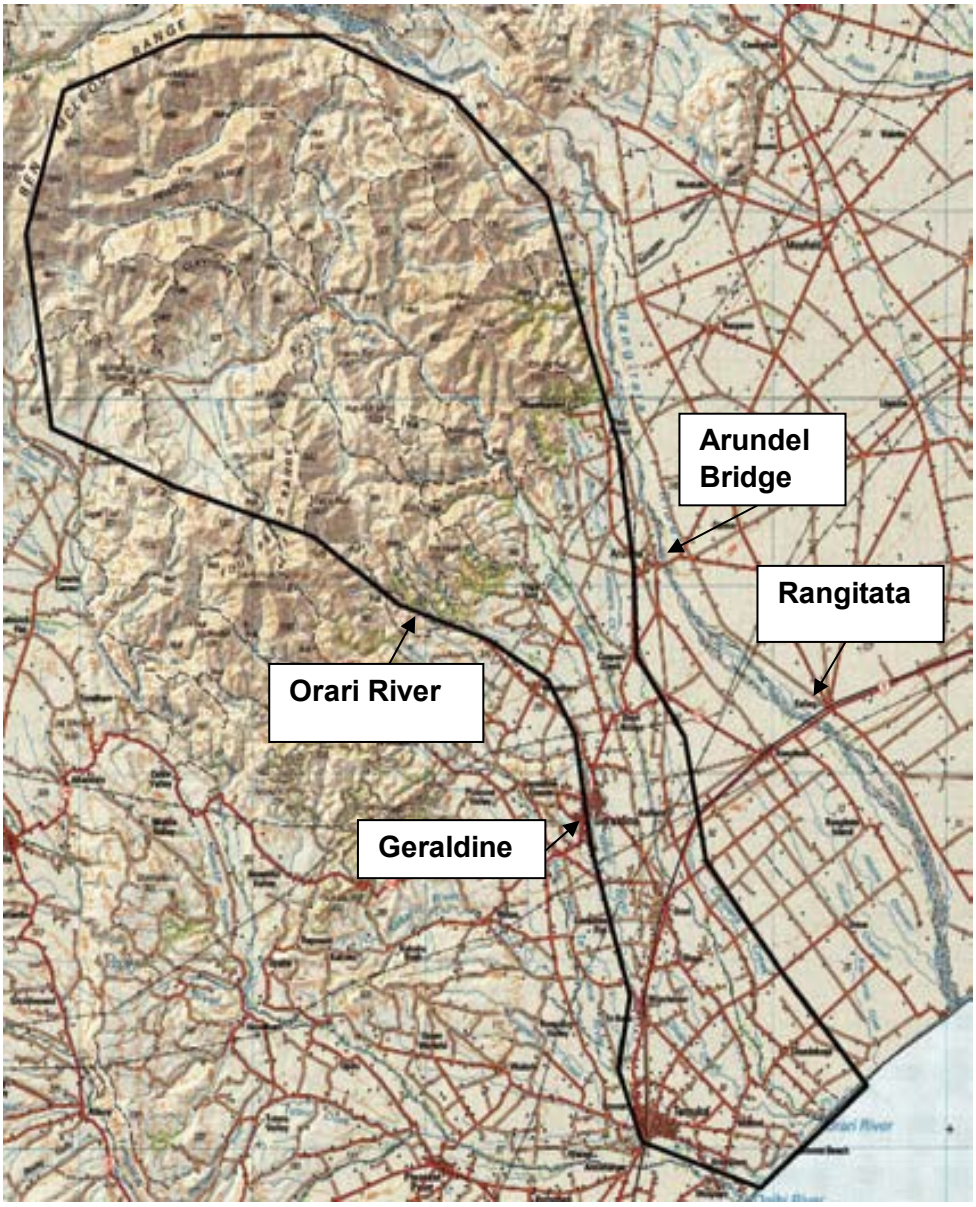
[42] Ostrom, E. (1990) *Governing the Commons: The Evolution of Institutions for Collective Action.* Cambridge University Press: Cambridge.

[43] The Water Conservation Order was eventually signed into law in 2006.

[44] Orari ICM Community Group (2008). Orari River Catchment Management Strategy, prepared for Environment Canterbury.

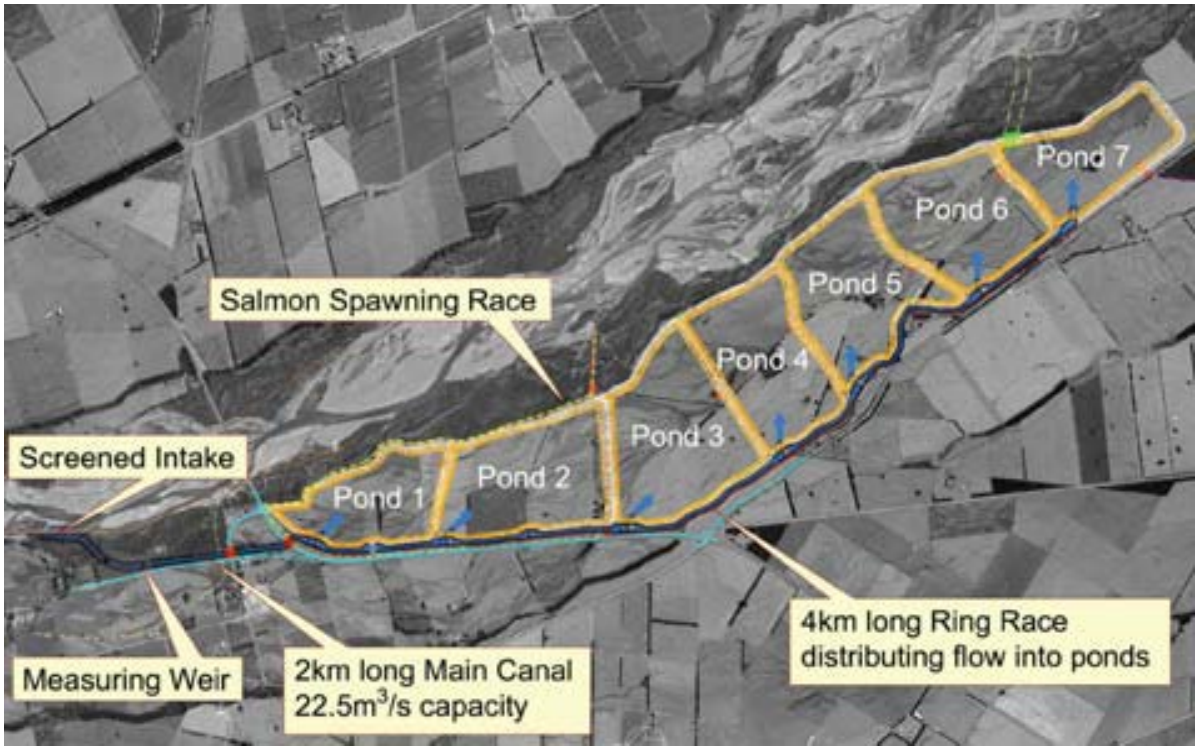
FIGURE 1: Orari River Catchment and Rangitata River[45]



RSIL proceeded with the consenting process with consents granted in 2009. The scheme is designed to take water from upstream of the Arundel Bridge mostly when flows are greater than 110 cumecs, store it in ponds covering 280 ha to a maximum volume of 16.5 Mm³. (see Figure 2.) Water is then distributed by existing stockwater and new races to the scheme's 30 shareholders to enable irrigation of 12,000 ha.

[45] Orari ICM Community Group (2008). Orari River Catchment Management Strategy, prepared for Environment Canterbury.

FIGURE 2: Off-River Storage based on the Rangitata River[46]



3. Hurunui Storage Options

In the Canterbury Strategic Water Study (Morgan et al 2002)[47], one of the areas identified where there was land capable of being irrigated but without reliable water supply was the Hurunui-Waipara catchments in North Canterbury. Stage 2 of the Study[48] identified the following storage options for the Hurunui:

- Lake Sumner: controlling outflows with a control gate structure
- Hurunui South Branch: a 75m high dam for irrigation
- Mandamus: dam upstream of the junction with the Hurunui
- Waitohi: tributary storage with pumped flows from the Hurunui
- Pahau; a 35m high dam for irrigation
- Waipara: possible sites at Greys Road and Clarke Hall Road.

The locations of the storage options are shown in Figure 3 and an economic comparison of them is set out in Table 1.

[46] Damwatch: Rangitata South Irrigation Case Study. www.damwatch.co.nz/rangitata.pdf, accessed 4/1/2013.
[47] Morgan, M., Bidwell, V., Bright, J., and McIndoe, I. (2002). Canterbury Strategic Water Study, prepared for Environment Canterbury, Ministry of Agriculture and Forestry and Ministry for the Environment.

[48] Riley Consultants (2010). Canterbury Water Management Strategy: North Canterbury Storage Options, prepared for Environment Canterbury.

FIGURE 3: STORAGE OPTIONS IN THE HURUNUI AND WAIPARA CATCHMENTS[49]

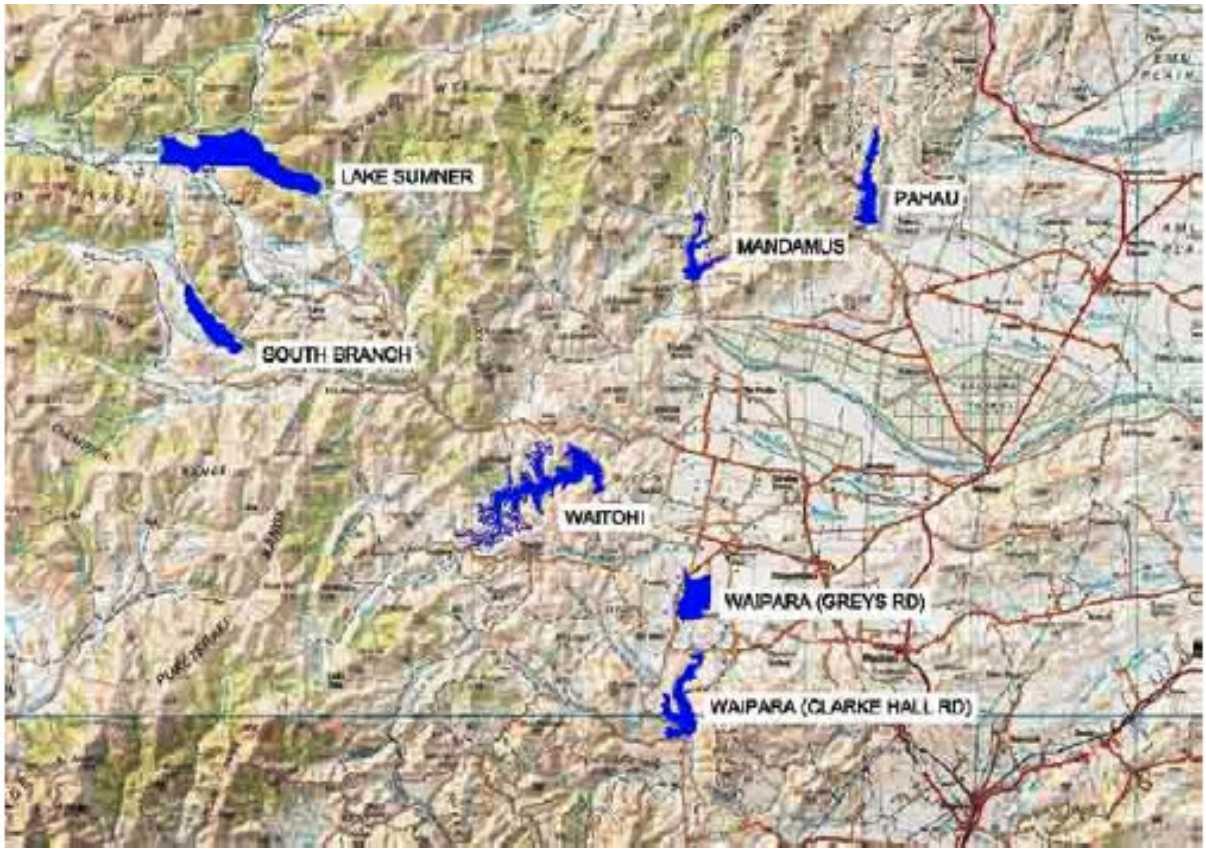


TABLE 1: ECONOMIC COMPARISON OF STORAGE OPTIONS

STORAGE OPTIONS	VOLUME (Mm^3)	CAPITALISED COST ($m)	UNIT COST ($m/$Mm^3$)
Lake Sumner	37	3.0	0.08
Hurunui South	96	32.8	0.34
Mandamus	35	16.2	0.46
Waipara North Branch	30	20.1	0.67
Waitohi	130	94.5	0.73
Pahau	20	16.1	0.81

In order to achieve the potentially irrigable area, the low cost approach was for a combination of control gates on Lake Sumner and a storage on the Hurunui South Branch. Of the potentially irrigable land in the area (74,671ha), there are 7,336 ha of existing irrigation. The combined Lake Sumner and Hurunui South Branch proposal could irrigate a further 67,900 ha.

[49] Riley Consultants (2010). Canterbury Water Management Strategy: North Canterbury Storage Options, prepared for Environment Canterbury.

The Hurunui Water Project Ltd was established and lodged a resource consent in June 2009 for the combination of control gates on Lake Sumner and a storage on the South Branch of the Hurunui River. Another RMA process had been put in train by NZ Fish & Game and Whitewater NZ; they had lodged an application in August 2007 for a Water Conservation Order to protect the Hurunui River. The WCO process had reached the point in August 2009 where the Special Tribunal appointed to assess the application had recommended that a conservation order be granted for the North Branch but not the South Branch. Whitewater NZ lodged an appeal to the Environment Court to include the South Branch.

In this time period, central government removed the elected council and replaced them with appointed commissioners. This required legislation – the Environment Canterbury (Temporary Commissioners and Improved Water Management) Act which was given assent on 12 April 2010. The Act also included a number of additional powers relevant to water storage in North Canterbury. One was the power to impose moratorium on specified consent applications (subject to government approval). A second varied the WCO process and the relevant criteria for decision making in relation to WCOs. A third was to remove appeals to the Environment Court but allow appeals on points of law to the High Court.

A moratorium was placed on consent applications for water associated with the Hurunui in July 2010 until October 2011. A further moratorium was placed on the adjacent Waiau River in December 2010 also until October 2011. This was to allow time to get a regional plan and an agreed storage strategy in place for the Hurunui.

A third RMA process was also in progress: the Natural Resources Regional Plan being prepared by the regional council. The NRRP had been notified as a draft in 2004 and the decisions were publicly notified in October 2010. The council's decision was to make damming the Hurunui a non-complying activity. This decision was appealed to the High Court by the Hurunui Water Project Ltd in November 2010.

Under the Canterbury Water Management Strategy, the Hurunui-Waiau Zone Committee was formed in July 2010 to develop the Zone Implementation Programme (ZIP) for the Hurunui-Waiau catchments. The RMA processes were set aside to see if this collaborative process could achieve an agreed storage strategy. The Zone Committee recommended investigation of the Waitohi alternative. The Waitohi Selection Panel was appointed to review and recommend on three Waitohi options.

As stated in the Report of the Panel "the purpose of the Panel was to expedite the development of irrigation storage in the Hurunui in the face of three substantive scheme proposals, by providing advice and recommendations on the merits of the schemes". Three proposals were compared: the Hurunui Water Project Ltd proposal with the main storage at Hurricane Gully, the Fraser Geologics proposal including power stations and a large dam in the lower Waitohi Gorge, and, the Direct Project Management proposal based on a dam in the lower Waitohi Gorge. The comparison was undertaken in 7 steps:

(1) Consultation with sponsors and proponents leading to a terms of reference for the Panel
(2) Presentations by proponents of their proposals
(3) Analysis of key criteria
(4) Site visit
(5) Draft reports prepared on information provided proponents and incorporation of their feedback
(6) Face-to-face discussions with proponents prior to preparing the final report
(7) Submitting the final report and recommendations to the sponsors.

The key selection criteria were considered to be:

- The capital cost per hectare and net present value of the scheme infrastructure
- Environmental acceptability and consequent consentability
- Potential contribution of hydroelectricity generation to offset costs to farmers
- A scheme proposal that could proceed at the earliest possible opportunity.

The decision-making process in the Hurunui-Waiau Zone introduced a new component of evaluation for alternatives to the initial proposal of a dam on Hurunui South Branch and control gates on Lake Sumner. This was an "affordability analysis" of different proponents' proposals by an independent panel (Waitohi Selection Panel, 2011).[50]

In evaluating the alternative proposals, affordability was the key issue along with policy alignment with the Canterbury Water Management Strategy. All proposals avoided the main environmental concerns of damming a main stem of a braided river and interfering with the levels of Lake Sumner which had been the main concerns of the earlier proposal. However, the taking water in Maori Gully was seen as a disadvantage of the Fraser Geologics proposal.

The Selection Panel favoured the Hurricane Gully alternative. This involved four storage dams on the Waitohi River and on-plains storage to irrigate 58,500ha in the Hurunui, Waipara and Kowai catchments. There are two intake structures to divert water from the Hurunui: one immediately downstream of the Mandamus confluence and the other 1.5km downstream of the confluence with Surveyors Stream. The consent application for this proposal was publicly notified in September 2012. Very few submissions were received compared to over a 1,000 (predominantly negative) submissions on the original proposal

4. Key Learning Outcomes

Three key learning outcomes relate to:

- improvements in alternative generation
- differences in the type of discussions between stakeholders
- limitations of the Resource Management Act

In relation to the generation of alternatives, the examples show that under RMA processes applicants focus on the lowest cost option and there is little incentive to consider alternatives that improve non-financial outcomes. However, for developments associated with resources with multiple users and at sustainability limits (i.e. common pool resources), the lowest cost option for the applicant may not be the lowest cost option for all users. The effects on other users can be considered to be unacceptable. The involvement of other users in generating alternatives can lead to acceptable cost alternatives for the applicants and acceptable effects for other users.

[50] Waitohi Selection Panel (2011). *Report of the Waitohi Selection Panel.* Submitted to Environment Canterbury, Hurunui-Waiau Zone Water Management Committee, Hurunui District Council and CWMS Regional Water Management Committee.

There is a marked difference in the nature of the discussion between applicants and other users in collaborative processes compared to RMA processes. In RMA processes, there is a tendency for applicants to defend their proposals and argue against the concerns raised by other users; and for other users to oppose applicant's proposals and focus on potential adverse effects. This creates an adversarial process with participants defending their respective positions. For well designed collaborative processes, there is the potential to move from antagonistic discussions to mutual recognition of the concerns of other participants and a willingness to consider alternatives.

The two case studies highlight the limitations of RMA processes in relation to the generation of sustainable alternatives for developments associated with common pool resources. The concept of applicant-driven proposals within the constraints of effects management is not sufficient to manage resources when resource use approaches sustainability limits. In the case of the Orari Dam proposal it required a community engagement process facilitated by the regional council to generate a more appropriate alternative. In the case of the Hurunui proposal it required formal withdrawal from RMA processes and the reliance on the collaborative governance approach of the Zone Committee for implementing the Hurunui-Waiau Zone component of the Canterbury Water Management Strategy to generate an acceptable alternative.

Appendix 4

Jenkins, B. R. and Henley, G. (2014) Collaborative Management: Community Engagement as the Decision-Making Process, The Australasian Journal of Natural Resources Law and Policy, V 17 (2) pp 135-153.

(Version prior to acceptance of publication)

COLLABORATIVE MANAGEMENT: COMMUNITY ENGAGEMENT AS THE DECISION MAKING PROCESS

BRYAN JENKINS AND GEOFF HENLEY*

ABSTRACT: Planner-led technical decision processes identify a step-wise process for making decisions which typically includes the following steps: define the problem, develop alternatives, evaluate alternatives, and make the decision. This can be extended to multi-criteria decision-making frameworks that can be used to score different factors and weight different criteria to provide overall evaluations of alternatives to indicate a preferred decision. There are also process-led legal decision processes that have been developed with complex submission and submission-on-submissions procedures to inform independent commissioners of the variety of viewpoints that need to be considered in their deliberations on the merits of proposals.

However, these technical and legal processes may not be the most effective decision-making processes for the sustainable management of scarce resources involving multiple users. Ostrom has identified "collective choice arrangements" as one of the design principles for the management of common pool resources, such as water or fisheries.

This paper describes the decision-making process for developing the Canterbury Water Management Strategy in New Zealand. This process was designed to be dynamic and collaborative with stakeholder and community engagement. The steps in the community engagement process defined the decision-making process. This is not to say that the technical and legal processes were not followed, rather, that they were subsidiary to the community engagement process.

The paper describes the activities associated with the seven milestones of the Canterbury Water Management Strategy community engagement process:

(1) Release and announcement
(2) Definition of the process
(3) Identification of the breadth of uses and benefits
(4) Public reporting of uses and benefits
(5) Achievement of depth and sophistication of strategies and substrategies
(6) Public engagement on strategy options
(7) Implementation and update.

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* Bryan Jenkins, BE (Hons)/ME (Adelaide), PhD (Stanford), MAdmin (Monash) is Professor, Strategic Water Management, Waterways Centre for Freshwater Management, University of Canterbury and Lincoln University, Private Bag 4800, Christchurch 8140, New Zealand; bryan.jenkins@canterbury.ac.nz. Geoff Henley, MSocAdmin (Victoria), is Executive Director, Stakeholder Relations for Network Communication P O Box 9691, Wellington 6141, New Zealand; geoff.henley@networkcommunication.co.nz. The work was undertaken when Bryan Jenkins was chief executive for Environment Canterbury and Geoff Henley was project consultant to the Canterbury Water Management Strategy for Environment Canterbury.

The community engagement process was successful in achieving widespread acceptance of the proposed strategy which is now being implemented. Whereas attempts at technical and legal processes for water management had led to disagreement and were unable to resolve water management conflicts.

KEYWORDS**:** Resource management decision making; Collaborative community engagement processes; Acceptance of strategic decisions.

CONTENTS

I INTRODUCTION

A *Decision-Making Processes*

The two dominant paradigms for decision making in relation to public planning decisions are planner-led technical decision making and process-led legal decision making.

An example of the planner-led technical decision making is set out in the American Planning Association's *Planning Theory for Practitioners*[51]. In this model the planner defines the problem, the planner considers alternatives and analyses them, choices are made for best-fit

[51] Brooks MP (2002) Planning Theory for Practitioners. American Planning Association, Chicago

considering feedback from the client group, and then the planner designs and implements courses of action[52].

An example of the process-led legal decision-making is Schedule 1 of the Resource Management Act in New Zealand[53]. This defines a process of plan notification, calling for submissions, allowing for further submissions on the submissions received, establishing a hearing panel to hear submitters, deciding by the hearing panel, and appeals to the Environment Court and further appeals to higher courts.

Another process-led legal approach comes from the UK Government *Planning Portal* website which sets out the process of how and when planning applications are decided and the options available once a decision is made.[54] The process includes checking alignment with local planning instruments, consulting on the proposal, developing recommendations to address issues raised, reporting to decision makers, decision notification and grounds of appeal.

Public planning decisions involve both planner-led technical aspects and process-led legal aspects with one usually more dominant than the other in different circumstances. This leads to either technical planners or the legal authority having the dominant role in decision making.

However for many planning decisions which involve multiple stakeholders with different values, the planner is unlikely to be the most appropriate person to identify all of the issues to be addressed, the most appropriate way of addressing those issues, how the different interests can be reconciled, and, the appropriate weighting of multiple decision criteria. It is the stakeholders themselves that are better qualified to perform these tasks[55]. Thus planner-led technical decision making is unlikely to be appropriate.

Furthermore, in terms of process, planning authority processes to assess planning proposals typically involve consultation with affected parties but the planning authority (or planning tribunal or court) is the arbiter between proponents and those affected (both supporters and opponents). However, these formal legal processes are unlikely to achieve reconciliation between proponents and affected parties. Indeed, there is a tendency for these processes to be adversarial[56]. Thus process-led legal decision making is unlikely to be appropriate.

Alternative approaches to designing decision making processes which directly involve the range of stakeholders affected by planning decisions are being proposed. These include

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[52] Further examples of evaluation for public planning decision making and evaluation methods are in McAllister DM (1982) Evaluation in Environmental Planning: Assessing Environmental, Social, Economic and Political Trade-offs. MIT Press, Cambridge, Mass.

[53] *Resource Management Act 1991* (NZ) Schedule 1, and Ministry for the Environment (2009) An everyday guide to the RMA: Getting in on the Act. Ministry for the Environment, Wellington,NZ.

[54] UK Government Department for Communities and Local Government (2014) Planning Portal. http://www.planningportal.gov.uk/planning/applications/decisionmaking/. Accessed 22 March 2014

[55] Jenkins BR (2013) The Development of Sustainable Alternatives to Applicant's Proposals pare presented to NZ Planning Institute Annual Conference Hamilton NZ, 30 Apr-3 May 2013.

[56] Lomax A, Memon A and Painter B (2010) The Canterbury Water Management Strategy as a Collaborative Planning Initiative: a preliminary assessment, Lincoln Ventures, Lincoln NZ.

collective choice arrangements described by Ostrom[57] and deliberative democracy described by Dryzek.[58] However there are few examples of how to design and incorporate such decision-making approaches into public planning processes[59]. This paper sets out an example of collaborative management where the community engagement process was designed and used as the decision-making process. This is the development of the Canterbury Water Management Strategy for the Canterbury region of New Zealand.

B *Outline of the Paper*

The paper initially provides background to the water situation in the Canterbury region and the shortcomings of technical planner-led and process-led legal approaches to resolve sustainability issues associated with water management in Canterbury. The body of the paper describes the community engagement process. The process delivered an agreed strategic framework for water management which had the acceptance of multiple stakeholders who had widely different views at the commencement of the process. The paper concludes with a summary of the innovations from collaborative decision making compared to technical planner-led and process-led legal decision making that have relevance to others facing planning issues where stakeholders have different perspectives. Some of the innovations included: a shift from a limited focus on water availability to a broader concept of integrated water management; new concepts for increasing water availability rather than storage on the mainstems of rivers, such as off-river storage, aquifer recharge and increased water use efficiency; new methods for identifying community values, decision making with incomplete information and multiple interests, and sustainability appraisal; processes which led to acceptance of outcomes rather than unresolved conflict.

II BACKGROUND

A *Sustainability Limits Reached*

There has been extremely rapid growth in water allocation and use in Canterbury in the last 20 years. This is predominantly associated with the expansion of dairying and the demand for irrigation water to improve pasture growth and thereby dairy production. New Zealand has the highest growth rate in irrigation of any OECD country[60] with most of that growth occurring in Canterbury which has 70% of New Zealand's irrigated land.

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[57] Ostrom E (1990) Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press, New York

[58] Dryzek J (2010) Foundations and Frontiers of Deliberative Governance. Oxford University Press, Oxford

[59] One example is CALFED – the Californian water planning and management process: refer to Booher DE and Innes JE (2010) Governance for resilience: CALFED as a complex adaptive network for resource management, Ecology and Society 15(3) 35. A second example is the NeWater Project where seven international river basins were selected as case studies: refer to Mysiak J, Henrikson HJ, Sullivan C, Bromley J and Pahl-Wostl C (2010) The Adaptive Water Resource Management Handbook, Earthscan, London.

[60] OECD indicates a 90% increase in irrigated area in NZ from 1990-2 to 2001-3 compared to the OECD average of 6%. OECD (2008). *Environmental Performance of Agriculture in OECD countries since 1990*. OECD Berlin Centre.

This has led to the sustainability limits of water availability in Canterbury being reached for the current means of abstraction for both surface water and groundwater[61]. It has also led to cumulative effects from land and water use which have compromised water quality and freshwater ecosystems.[62]

B *Strategic Investigations*

The first stage of strategic investigations into water management was commenced after droughts in the late 1990s indicated issues with water availability based on an analysis of future demand and supply.[63] This planner-led technical investigation indicated that, under low flow conditions in rivers from which irrigation water is taken, current peak demand cannot be met by current abstraction methods. Most irrigation abstraction was based on run-of-river schemes based on direct withdrawals from rivers. However, on an annual basis water is available to meet future demand but would require major water storages for water to be available in the irrigation season. This finding led to a second stage of strategic investigations to identify sites for major water storage options for the region with respect to their hydrologic feasibility.[64] This was also a planner-led technical investigation by consultants.

A third stage was designed as the evaluation phase of the potential storage options by a 20-person multi-stakeholder group. This group was supported by subregional groups (for north, mid and south Canterbury) that provided input to the evaluation. The multi-stakeholder group used a sustainability framework for comparingstorage options. However, they also expressed concerns about broader water management issues and the multi-stakeholder group recommended that before strategic water storage and water management decisions are made, rigorous scientific and public consideration is required of:

- the impacts of land use intensification and its effects on water quality,
- mitigation and management systems for water quality, and,
- methods for maintaining or improving flow variability and low flows in major rivers.[65]

This led to a fourth stage – the development of the Canterbury Water Management Strategy (CWMS). It is the community engagement process as part of the CWMS that is the subject of this paper.

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[61] Irrigation was primarily by run-of-river withdrawals (i.e. direct takes from rivers) and groundwater pumping from unconfined aquifers. For run-of-river withdrawals the sustainability limit is reached when available flow in the river above environmental flow requirements cannot meet the total water allocations granted to water users. For unconfined groundwater extraction the sustainability limit is reached when the volume extracted by all users exceeds the allocation limit based on aquifer recharge for the groundwater basin.

[62] Jenkins, B. R. (2009). *Canterbury Water Management Strategy: A Region-Wide Approach to Improve Water Management.* Paper presented at National Water 2009 Conference, 18-20 August 2009, Melbourne.

[63] Lincoln Environmental (2002). *Canterbury Strategic Water Study.* Prepared for Environment Canterbury, Ministry for Agriculture and Forestry, Ministry for the Environment. Technical Paper 2002/6.

[64] Aqualinc Research Limited (2008). *Canterbury Strategic Water Study (Stage II).* Prepared for Environment Canterbury, Report No. LO5086/1.

[65] Whitehouse, I. Pearce, A. and McFadden, G. (2007). *Final Report – Canterbury Strategic Water Study (CSWS) Stage 3 – multi-stakeholder evaluation of water storage options.* Prepared for Environment Canterbury, Christchurch.

C *Statutory Processes*

While the strategic investigations (that were planner-led technical studies) were underway a number of statutory processes (i.e. process-led legal processes) were also in progress. One was the development of a Natural Resources Regional Plan[66] for Canterbury. Regional plans are statutory instruments prepared by regional councils under the *Resource Management Act 1991* (NZ) (RMA) that state the objectives for the region for natural resources, the policies to implement the objectives, and the rules to implement the policies. There were also applications for Water Conservation Orders (WCOs) by environmental interests in progress.[67] WCOs provide for the preservation of water bodies in their natural state, and protection of environmental values and outstanding Maori values of water bodies. There were also a series of controversial irrigation and hydro generation projects initiated by development interests that were progressing through resource consent processes.[68]

All of these statutory processes were based on procedures specified in the RMA: Schedule 1 for the preparation of a regional plan, Part 6 for resource consents and Part 9 for WCOs. Community involvement in these processes was as affected parties or submitters (typically in opposition). The legalistic nature of the processes created an adversarial system for decision making. Information was in the form of evidence to hearing processes in an interrogative process and legal judgement formed the basis of decisions, usually in the Environment Court. Processes were protracted and acrimonious[69].

D *Paradigm Shift*

The technical planner-led process with its limited focus on major storage to address the single issue of water availability had been found by the stakeholder response to be insufficient to address the broader water management issues, such as water quality and environmental flows. The process-led legal processes had been unable to effectively resolve the conflicting perspectives for water management in the region.

A different paradigm was needed. Work on collaborative approaches had been initiated in 2004 by the regional council at the scale of tributary catchments with considerable success at resolving water management issues at this scale[70]. It was clear that the Canterbury water

[66] Enviroment Canterbury (2011) Natural Resources Regional Plan. Environment Canterbury, Christchurch
[67] One for the Rangitata River and later one for the Hurunui River.
[68] Major projects included Project Aqua, Central Plains Water and the Hurunui Water Project.
[69] Milne P, Nixon B, Fenemor A and O'Callaghan R (2010) Joint Decision and Recommendations of Independent Commissioners (for Central Plains Water Limited consent application), Part 2 Discussion of Disputed Conditions, 28 May 2010. Fernando A and Werellagame I (undated) Comparison of planning and consenting procedures for water resource projects in Sri Lanka and New Zealand, http://unitec.researchbank.ac.nz/bitstream/handle/10652/Fernando_Comparison_of_planning_and_consenting_pdf. House of Representatives Commerce Committee (2003) 2002/3 Financial review of Meridian Energy Limited, Wellington NZ. Stevens C (2003) Waitaki Catchment – nonsense or national necessity, Resource Management Journal 3, XI, p9-11. TVOne News (16 10 2009) Hundreds protest Hurunui dam project, http://tvnz.co.nz/national-news/hundreds-protest-hurunui-dam-project-3079784.
[70] Gunningham N (2008) Innovative Governance and Regulatory Design: Managing Water Resources. Landcare Research Report LC0708/137, Landcare Research, Lincoln NZ.

management issues needed to be considered at multiple scales. For Canterbury there were at least four spatial scales:

- the regional level where the key issues are water availability and land use intensification,
- the catchment level at which the sustainability levels of water use, the cumulative impacts of water use, and, the reliability of supply for irrigation are the main issues,
- the subcatchment level, where environmental flow requirements in river reaches and the management of stream water quality and riparian margins are the main issues, and
- the property level, where the land use practices that influence water quantity and quality are defined.

An overall strategic framework was formulated based on Ostrom's self-managed community approach to governing common pool resources[71] and Gunderson and Holling's concept of nested adaptive systems for managing natural resources.[72] One of the key elements of Ostrom's design principles for managing common pool resources, such as water, is the "collective choice arrangements". This paper describes the community engagement process based on Ostrom's concept of collective choice arrangements that was undertaken to facilitate collective decision making for the Canterbury Water Management Strategy (CWMS), Stage 4 of the strategic process.

III Overview of CWMS and the Community Engagement Process

A *Canterbury Water Management Strategy*

The Canterbury Water Management Strategy involved the following major activities:

- stakeholder and community engagement on the development of strategic options,
- definition of the strategic options,
- community consultation on their option preferences,
- strategic investigations of outcomes, and
- sustainability appraisal of options.

From Stage 2 of the strategic investigations, the strategy process had been reporting to the Canterbury Mayoral Forum which comprised all the mayors of the district and city councils and the chair of the regional council and their chief executives. A Steering Group under the

[71] Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action.* Cambridge University Press, New York. Ostrom considers institutional designs for common pool resources such as water. She compares different governance models: government direction, privatisation and self-managed communities. Her research indicates self-managed communities as the most enduring form of institutional design for common pool resources and identifies institutional design principles for self-managed communities.
[72] Gunderson, L. H. and Holling, C. S. (2002). *Panarchy: Understanding Transformations in Human and Natural Systems.* Island Press, Washington. Gunderson and Holling provide an operational framework for defining sustainability on the basis of an "adaptive cycle" of exploitation of resources, accumulation of material, disturbances to the system and its potential to reorganise after disturbance. Adaptive cycles are "nested" – operate at different spatial and time scales but are linked.

auspices of the Mayoral Forum provided oversight of the process which was managed by the Regional Council. For Stage 4, the membership and role of the Steering Group was expanded. It comprised representatives of local and regional government, tangata whenua[73] as well as farming, environmental, industry and recreational interests. It was empowered to make recommendations to the Mayoral Forum.

B *Stakeholder and Community Engagement Process*

The community engagement process in Stage 4 had activities based on seven milestones:

1. Release and announcement of the process
2. Definition of the process
3. Identification of the breadth and uses and benefits
4. Public reporting of uses and benefits
5. Achievement of depth and sophistication of strategies and substrategies
6. Public engagement on strategy options
7. Implementation and update.

Milestone 1 (Release and Announcement) involved the release of the Stage 3 report and the commencement of the Canterbury Water Management Strategy. A clear separation was sought by the Steering Group for the shift from the technical work that had been focussed on storage to a broader concept of water resource management in order to highlight the change in emphasis.

Milestone 2 (Defining the Process) had the objective of defining an effective and credible process for the development of a strategy for integrated water management in contrast to the more limited scope of water availability and storage which had been the focus of the earlier work. Key activities undertaken to achieve the milestone were:

- Face-to-face briefings and discussions with stakeholders,
- Email exchanges with more remote stakeholders, and
- Approval of the Steering Group of the process.

One of the key principles of Ostrom is for community to be able to influence the design of the collective decision-making process.

Milestone 3 (Identifying Breadth of Uses and Benefits) had the objective of ensuring a broad identification of uses and benefits of all stakeholders for incorporation in a water management strategy. This was an extensive activity involving eleven stakeholder engagement meetings throughout the region and seven meetings on specific topics. It used a collaborative governance software package *Open Strategies* as a framework for engagement and as a web-based recording system of stakeholder views on the uses and benefits of water in the Canterbury region.[74]

[73] Tangata whenua means 'people of the land' in Maori and refers to people with a traditional connection to the land.

[74] Driver P (2014) Validating Strategies: Linking Projects and Results to Usews and Benefits. Gower, Farnham

Milestone 4 (Public Reporting of Uses and Benefits), involved the documenting the outputs of the stakeholder engagement process, and making the outputs publicly available and open to public scrutiny. A web site (*Canterburywater.org.nz*) was established for all reports associated with the development of the water management strategy. Also, *Open Strategies* had the facility for stakeholder groups to review how their views had been recorded and to modify the wording of how their views had been expressed.

Milestone 5 (Achieving Depth and Sophistication of Strategies and SubStrategies) had the objective of focussing stakeholders on defining and prioritising substrategies and projects to provide for the uses and benefits identified at Milestone 3 (or as modified from Milestone 4). The original intention was to use the facility in *Open Strategies* which links *P*rojects and their *R*esults to achieving *U*ses and *B*enefits (PRUB). However, it was found that there were thousands of linkages to be considered and the available technical data had limitations in quantifying the PRUB linkages. For community engagement a less detailed and higher level approach was needed which could cope with greater information uncertainty. As discussed further in section VI below, the *Strategic Choice* framework[75] was chosen to identify strategic options for regional water management.

Milestone 6 (Public Engagement on Strategy Options) had the objective of presenting to the public the strategic options for regional water management that had emerged from the stakeholder engagement process. This was designed to ensure that the public was fully aware that this was an opportunity to have significant input into the water management strategy.

Milestone 7 (Implementation and Update) had the objective of incorporating the Canterbury Water Management Strategy into statutory documents, creating methods for updating the strategy, and developing projects to implement the strategy.

The stakeholder and public engagement tasks - Milestones 3 to 7 - are discussed in more detail below.

IV IDENTIFICATION OF USES AND BENEFITS (MILESTONE 3)

Based on the work on defining the process from Milestone 2 discussions there was support for stakeholder group meetings at locations across the region. Eleven locations were identified.[76] There was also interest in addressing specific topics: economics (relating to energy and tourism); tangata whenua (Ngai Tahu and runanga)[77]; youth; water quality and drinking water; and, land use intensification.

Facilitated workshops were conducted by the regional council using the web-based collaborative governance tool *Open Strategies* to document the input from the variety of workshops in a coherent framework. The concept of *Open Strategies* is to enable

[75] Friend, J. and Hickling, A. (2005). *Planning under Pressure: The Strategic Choice Approach (Third Edition).* Elsevier, Amsterdam.

[76] From north to south these locations were Hurunui, Rangiora, Central Christchurch, Akaroa, Darfield, Rakaia-Methven, Ashburton-Hinds, Timaru, Fairlie, Waimate, and Omarama.

[77] Ngai Tahu is the Maori tribe whose rohe (tribal territory) includes the Canterbury Region. Runanga are Maori groupings centred on the whanau (family) and hapu (sub-tribe) of marae (tribal meeting place) based communities.

multistakeholder groups to define multiple projects that can contribute to the range of benefits sought by the multiple interests. The *Open Strategies* framework links projects to the results achieved by those projects; the results are linked to uses of these results to members of the community; and the uses are linked to benefits to the community.

Milestone 3 was to define the breadth of uses and benefits that the stakeholders sought from water management in Canterbury. The purpose of the workshops was for stakeholders to identify their uses and benefits. Community input to this process was extensive. Summaries of the output of the workshops are still displayed on the *Canterbury Water* website.

The workshops also led communities to identify values associated with water that were at a higher level than benefits from water use by different stakeholders.

The process of identifying uses and benefits using the facilitated workshops was pivotal as the starting point in defining for the CWMS a vision statement, a definition of priorities and principles to underpin the strategy, and, ten target areas for the strategy that projects and actions that form the strategy are designed to achieve.

V Public Consultation and Reporting on Principles and Uses and Benefits (Milestone 4)

From the outcomes of the stakeholder workshops there were more than 4,500 stakeholder comments. Using thematic analysis *Open Strategies* identified 11 themes based on stakeholder values that could underpin a water management strategy for Canterbury. It also summarised the range of uses and benefits identified in the stakeholder workshops. This was received by the Steering Group and public feedback was sought on this information.[78]

From the Steering Group review of the public feedback the eleven themes were modified into ten fundamental principles: sustainability; kaitiakitanga;[79] instream values; region-wide (in terms of input and statutory adoption); non-abstractive uses (e.g. food gathering and swimming); efficient and effective water and land management; drinking water; maintenance of essential character of waterways; public access to waterways; stock exclusion from waterways. There was also a wide-ranging specification of uses and benefits under general categories of economic, environmental, cultural and social.

The public input confirmed the list of uses and benefits and suggested some changes to the fundamental principles.

VI Achievement of Depth and Sophistication of Strategies (Milestone 5)

A *Strategic Choice*

An important component of strategy formulation is selecting a framework designed for the type of decision situation. *Open Strategies* required information on the links between

[78] Canterbury Water (2008). *Milestone 4: Stakeholder & Public Consultation Guide on the Uses and benefits of Water in Canterbury.* Prepared for Environment Canterbury.

[79] Kaitiakitanga means the exercise of guardianship by the tangata whenua of an area in accordance with tikanga Maori (Maori customs) in relation to natural and physical resources.

projects, results, uses and benefits. While some of this information had been generated there wasn't sufficient information to make effective use of the *Open Strategies* framework for the development of alternative regional water management strategies. The development of strategic options was facilitated by the use of *Strategic Choice*.[80] This approach for option development and selection arose from experience of decision making in environments where interorganisational collaboration was essential to successful service delivery.[81] It is more a method of problem structuring rather than problem solving. It is designed for finding solutions to complex problems where there is incomplete information, many interconnecting issues, uncertainty about possible effects of options, and multiple interests with conflicting objectives.

Rather than the planner-led technical decision process of "define problem/develop alternatives/evaluate alternatives/make decision", *Strategic Choice* considers multiple problems are to be addressed and comprises four modes of "shaping, designing, comparing and choosing" in order to deliver a commitment package including multiple decision outputs. The commitment package includes early actions, explorations in response to uncertainty, and arrangements for deferred decisions. A workshop of the Steering Group and technical support group addressed the shaping and design modes. This led to four strategic options which were subject to sustainability appraisal workshop (comparing mode) and a choosing mode involving community consultation, public hearings and stakeholder engagement. The Strategic Framework document[82] set out the commitment package.

The shaping mode involves defining *key decision areas* which were derived by the uses and benefits from Milestone 4. It also involves identifying *links between decision areas* as well as *other decision areas* that could be affected by courses of action to achieve uses and benefits. In addition, this mode includes defining priority decision areas in terms of urgency and importance (referred to as *problem focus*). A key input for these tasks was the Canterbury Regional Environment Report[83] which had analysed the resources, processes and outcomes with respect to water management in Canterbury.

The designing mode involves identifying possible options for each decision area and then the incompatibilities between options in order to develop a working shortlist of possible strategic options. There had been two camps prior to this stage in strategy development. One camp favoured further storage as the priority. The other camp opposed storage and wanted the adverse effects of water use and land use intensification addressed before any further storage development was contemplated. The workshop identified another option of improved water use efficiency which would make additional water available and reduce the water quality

[80] Friend, J. and Hickling, A. (2005). *Planning under Pressure: The Strategic Choice Approach (Third Edition).* Elsevier, Amsterdam.
[81] Midgley, G. (2000). *Systemic Intervention: Philosophy, Methodology, and Practice*. Kluwer Academic, New York.
[82] Canterbury Water (2009). *Canterbury Water Management Strategy: Strategic Framework*. Prepared by Environment Canterbury for the Canterbury Mayoral Forum.
[83] Environment Canterbury (2008). *Canterbury Regional Environment Report 2008.* Environment Canterbury, Christchurch.

contamination from excess runoff or groundwater leakage but would involve reconfiguration of existing consents.

B *Strategic Options*

From the *Strategic Choice* workshop, four strategic options were agreed by the Steering Group for public consultation:

- Option A: Business as usual (base case) – current RMA approach that was effects-based and applicant-driven;
- Option B: Advance environmental protection first then infrastructure development – set limits, initiate restoration and improve efficiency;
- Option C: Reconfigure consents and infrastructure to improve reliability and enhance the environment – redistribution for integrated water management;
- Option D: Advance infrastructure development with environmental repair and protection – storage incorporating environmental mitigation.

VII PUBLIC ENGAGEMENT ON STRATEGY OPTIONS (MILESTONE 6)

A *Public Consultation on Options*

All households in Canterbury (about 150,000) had delivered to them a booklet describing the fundamental principles and the four strategic options for regional water management.[84] Over 1,000 submissions were received and more than 100 were heard at public hearings conducted by the Steering Group members. The booklet also included a request for feedback on the preferred option. From the responses it was clear that there was little support for Option A (Business as Usual). Option D (Storage led strategy) and Option B (Environment led strategy were the most favoured. However, Option C (Efficiency-led strategy) received considerable first preference support and was the dominant second preference.

B *Sustainability Appraisal*

The four options were subject to a Sustainability Appraisal by the Steering Group and an Officials Group (technical advisors) using the Framework developed by Sadler and Ward[85] to reflect New Zealand institutional arrangements. The Framework is founded on four pillars of sustainability (social, economic, environmental and cultural) which correspond to the four well beings of the Local Government Act.

The appraisal process involved an intensive month-long period of identifying sets of social, economic, cultural and environmental capital assets that are involved in the regional water management and selecting assessment criteria to reflect these assets. In an application workshop involving community representatives and technical specialists over two days[86],

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[84] Enviroment Canterbury (2009) Creating a sustainable future for Canterbury water. Environment Canterbury, Christchurch

[85] Sadler, B. Ward, M. And Frame, R. (2008). *A Framework for Sustainability Appraisal in New Zealand.* Landcare Research Contract Report LC 0708/090, Lincoln.

[86] Russell, S. and Ward, M. (2010). *Sustainability Appraisal: Application to the Canterbury Water Management Strategy.* Landcare Research Contract Report LC0910/052. Landcare Research, Lincoln.

participants reviewed evaluation criteria and scale descriptions for the four groups of capital assets on a 5-point scale (from -2 strong negative impact to +2 strong positive impact with the neutral position 0 representing the status quo). Once the evaluation criteria had been amended, each group was asked to identify points on the five-point scale that represented an acceptable minimum position (quadruple bottom line) and a desirable objective position (quadruple top line).

The four options were then scored against the amended evaluation criteria. Some of the key findings of this appraisal were as follows:

- Option A (business as usual) was below the sustainability bottom line on nearly all criteria;
- Option B (environment-led) scored well on environmental criteria but is below the bottom line on economic criteria;
- Option D (storage-led) scored well on economic criteria but is below the bottom line on environmental criteria;
- Option C (efficiency-led) scored above the bottom line on nearly all criteria.

When considered at the sub-regional level, the workshop participants considered that combinations of Options B, C and D were most likely to achieve sustainability at the sub-regional level.

VIII STRATEGIC FRAMEWORK AND IMPLEMENTATION PROGRAMME (MILESTONE 7)

A Strategic Framework document prepared under guidance from the Steering Group was released by the Canterbury Mayoral Forum in November 2009.[87] The document provided a vision and principles for the CWMS. The vision statement of what success would look like for the desired outcome of the CWMS is: "To enable present and future generations to gain the greatest social, economic, recreational and cultural benefits from our water resources within an environmentally sustainable framework."[88]

First order priorities for water management were identified in the Strategic Framework document as: "environment, customary use, community supplies and stock water". Second order priorities were: "irrigation, renewable electricity generation, recreation and amenity".

Primary principles for defining the basis for water management were identified as: "sustainable management, regional approach, and tangata whenua". Supporting principles were: "natural character, indigenous biodiversity, access, quality drinking water, recreational opportunities, and community and commercial use".[89]

It also summarised the key challenges facing the Canterbury region and the outcomes of the CWMS process with respect to regional water management options and their sustainability

[87] Canterbury Water (2009). *Canterbury Water Management Strategy: Strategic Framework*. Prepared by Environment Canterbury for the Canterbury Mayoral Forum.

[88] Ibid, 6.
[89] Ibid, 8.

assessment. CWMS has been designed to deliver on a balanced set of outcome targets in the following areas:

- Drinking water
- Irrigated land area
- Energy security and efficiency
- Ecosystem health/biodiversity
- Water use efficiency
- Kaitiakitanga
- Regional and national economic growth
- Natural character of braided rivers
- Recreational and amenity opportunities.
- Environmental limits

The Strategic Framework document also provided the approach for developing the implementation programme for the strategy and the issues to be covered by those programmes. It continues the nested approach to collaborative governance with a multistakeholder Region Committee to address regional issues and 10 Zone Committees of community members and runanga representatives to facilitate community-driven implementation programmes to meet the CWMS targets. A Water Executive unit, as part of the regional council, was established to facilitate the delivery of the implementation programmes. In addition, the strategic framework document indicated how these programmes would be given statutory backing through regional policy statements and regional plans.

IX CONCLUDING COMMENTS

Five years on from the release of the Strategic Framework document, the approach set out in that document is still guiding water management in Canterbury[90]. A key element of the success of the collaborative approach for developing the strategic framework was the design of the community engagement process as the driver of the decision-making process. This included involvement in the design of the process, compared to having a predefined statutory process. The community involvement in defining the issues to be addressed, the options to be considered and the evaluation of the options differs from technical decision-making processes which are usually undertaken by technical experts and professional planners.

From a starting situation where there was polarisation of community views about whether water storage and associated land use intensification should proceed, there was widespread support for the strategic framework for integrated water management that delivers on multiple targets. The strategy development process shifted from a focus on water availability and storage to identification of community values and the wide range of uses and benefits associated with water. The acceptance of the strategy appeared to be related to the ability to

[90] Jenkins BR (2013) Progress of the Canterbury Water Management Strategy and some emerging issues. New Zealand Agricultural and Resource Economics Society Annual Conference, 29-30 Aug 2013, Lincoln University NZ.

be involved in and to influence the strategy development, as well as the outcomes of the process.

The use of a facilitated collaborative process resulted in a greater level of dialogue between different stakeholder interests compared to the adversarial style of statutory processes. This led to new concepts for increasing water availability being brought into the process such as different types of storage, e.g. tributary storage and aquifer recharge[91] and water use efficiency.[92]

The emphasis on community engagement led to the introduction of innovative methods. *Open Strategies* enabled a stakeholder definition of uses and benefits for water. *Strategic Choice* was able to accommodate incomplete information and multiple interests with conflicting objectives. *Sustainability Appraisal* was based on the simultaneous achievement of multiple criteria rather than trade-offs between objectives.

The use of collective choice arrangements required innovative processes and methods compared to typical technical and statutory decision processes and led to greater acceptance of the outcomes and improved likelihood of their implementation.

[91] Jenkins, B.R. (2013). *The Development of Sustainable Alternatives to Applicant's Proposals Using Collaborative Approaches.* Paper presented to NZ Planning Institute Annual Conference, 2 May 2013, Hamilton.
[92] Jenkins, B.R. (2012). *Water Issues in Canterbury.* Plenary address Agronomy Society of NZ Annual Conference 2012, Lincoln University.

Appendix 5

Jenkins, B.R. 2017. Evolution of Collaborative Governance in Canterbury Water Management, XVI Biennial IASC Conference Practicing the Commons: Self-Governance, Cooperation and Institutional Change, 10-14 July 2017, Utrecht, Netherlands. https://www.iasc-commons.org/papers-iasc2017-dlc/

Evolution of Collaborative Governance in Canterbury Water Management

IASC Conference, Practicing the Commons, Utrecht 10-14 July 2017

Bryan Jenkins[93]

Abstract

Collaborative governance in Canterbury has evolved through stages beginning with an experimental stage at the tributary and catchment scale before proceeding to a second stage of regional strategy development. The third stage was developing implementation programmes through Region and Zone Committees. It is now entering a fourth operational stage focused on farmer collectives. The paper describes the characteristics of these stages and compares them in relation to their dominant spatial scale, their governance arrangements, communication with stakeholders and community, approach to decision-making, funding, and their objectives.

With the inability of resource management legislation to provide the basis for managing water at sustainability limits and the increasing adversarial nature of court-based decisions, the regional council began to introduce the principles of Ostrom's "self-governing communities" for water management issues. One programme, "Living Streams", had three stages: an investigation stage; an involvement stage with landowners and community groups, and, an improvement stage of undertaking actions. There were also collaborative catchment management programmes to resolve community water conflicts. The programme was often initiated by community concerns being brought to the council. The programme involved getting stakeholder engagement, compiling information, option development with stakeholders, reaching agreement, and statutory backing to agreements.

The success of collaborative approaches at the tributary/catchment scale led to a collaborative governance framework being adopted for a regional strategy. The focus was on the regional scale but also considered, subregions of interconnected catchments and groundwater zones, tributary catchments, and individual properties. A programme of structured stakeholder engagement and region-wide community consultation was developed. Decision-making was by a multi-stakeholder steering group informed by community input and endorsement by the Mayoral Forum.

The strategy defined the governance structure for developing implementation programmes with a nested system of a Regional Committee focused on regional issues and ten Zone Committees focused on subregional issues. The dominant component was the zone level. The operating philosophy was for a collaborative, co-operative, participatory and solutions-focused approach.

Water quality has been the focus for operational management. The main operational elements are adoption of good management practices, setting nutrient contaminant limits, linking limits to catchment nutrient loads, and, allocating catchment loads among existing users while creating headroom for new users. The primary governance element is farmer collectives. The compliance approach is based on audited self-management with an independent audit process of performance assessment and outcomes at the property level.

[93] Dr Jenkins has recently retired from the position of Professor, Strategic Water Management at the University of Canterbury and Lincoln University in Christchurch, New Zealand. Prior to that he was chief executive of the Canterbury Regional Council and was responsible for introducing collaborative governance to water management in Canterbury.

The first experimental stage was small scale. Then there is a trend in the collaborative governance arrangements as water management moved from strategy to implementation then operations of: decreasing dominant spatial scale (from region to subregional zone to tributary/irrigation district), increasing formality (from non-statutory to statutory), and decreasing scope of decisions (from all issues to ten target areas to selection of management approach). Multiple scales are relevant to all stages. One unresolved issue at the operational scale is how infrastructure beyond the scale of farmer collectives will be managed and funded. Other unresolved issues are around infrastructure development, ability of solutions packages to meet desired outcomes, and implementation progress.

Introduction

This paper describes the evolution of collaborative governance in water management in Canterbury, New Zealand. The introduction of collaborative governance was a result of the failure of the existing institutional arrangements based on effects-based management and legal process to resolve water quantity and quality issues when sustainability limits of water availability and the cumulative effects of land use intensification had been reached.

Collaborative governance arrangements have gone through four distinct stages (1) an experimental stage, (2) the development of a regional strategy, (3) the preparation of zone implementation programmes, and (4) an operational stage based on farmer collectives. These four stages have quite different characteristics with respect to (a) their dominant spatial scale, (b) their governance arrangements, (c) the means of communication with stakeholders and the community, (d) the approach to decision making, (e) the means of funding, and (f) their objectives.

In the next section of the paper the New Zealand institutional arrangements based on effects management and legal process are outlined. This is followed by the water management issues facing the Canterbury region, primarily due to the significant expansion of irrigation for land use intensification from dryland farming to dairying. After that, the four stages of collaborative governance are described. This leads to a comparative analysis in relation to spatial scale, governance, means of communication, decision making, funding and objectives.

The shift from effects-based management and legal process to collaborative governance has led to a paradigm shift in water management in the Canterbury region. However, there are still unresolved issues. The final section sets out some of the key issues to be resolved.

New Zealand Institutional Arrangements

There was a major reform of natural resource management in the late 1980s in New Zealand. The number of local and regional government units was reduced from 625 to 94. The most significant innovation for water resource management under the new arrangements was the creation of regional councils whose geographical boundaries were based on natural river catchments. Regional councils are elected local government bodies that coordinate, and set policy for resource management, including water and soil conservation, and transport. They also have roles in pest management, civil defence, navigation safety, coastal management, hazardous waste and more recently biodiversity management (Wallis and Dollery 2000).

Coincident with these reforms was the introduction of the Resource Management Act (RMA) in 1991. The purpose of the Act is to promote sustainable management. The legislation is “effects-based” and concentrates on the environmental effects of activities rather than the activities

themselves. The focus is on environmental effects and leaves the pursuit of economic and social goals to other mechanisms. The legislation incorporates the principles of the Treaty of Waitangi.[94]

The reforms also led to the creation of the Ministry for the Environment. The Ministry of Works and Development which had a major water resource development role in building hydro-generation and irrigation infrastructure was abolished in 1988. There is no natural resources agency in central government in New Zealand. The Ministry for the Environment has responsibilities for National Environmental Standards and National Policy Statements. For 20 years, there were no standards or policies relating to water management at the national level. The first National Policy Statement on water was gazetted in 2011.

Regional councils are required to prepare Regional Policy Statements identifying environmental issues and responses of significance for its region. Regional councils also have the authority to prepare Natural Resources Regional Plans which can include water management. Territorial authorities (city and district councils), the next tier of local government, are required to prepare District Plans which cover land use and subdivision. Regional councils have the authority to issue resource consents for the taking and use of water, and for discharges to water, and, to monitor compliance with those consents. Territorial authorities have the authority to issue consents for land use.

The reforms also created an Environment Court. The Court has extensive powers not only to consider appeals on resource consent decisions but also on regional policy statements and plans. The Court has the ability to review the technical merit of decisions. This has made resource management in New Zealand a highly legalistic process. It has also led to an adversarial style of decision making.

Furthermore, there was also a marked change in the role of government. The previous role of government involved directing economic activity and making trade-offs in the interests of the wise use of resources. As stated by Simon Upton, the Minister responsible for the passage of the Act through Parliament: “the Government moved to underscore the shift in focus from planning for activities to regulating their effects” (Upton 1995).

The Resource Management Act was also designed on the premise that people know best what it is that they are after in pursuing their well-being (Upton 1995). Thus, the responsibility for defining proposals was left to proponents. The RMA was designed on the basis of “effects management”, i.e. that choices by applicants would be constrained by bottom lines of effects that were not to be exceeded.

This approach may be suited to circumstances where there is an abundance of resources. However, when resource use approaches sustainability limits, either in terms of resource availability or in terms of cumulative effects of resource use, then the actions of one user can harm all others. Indeed for a common pool resource (i.e. a resource that is readily accessible and difficult to exclude access to, and, is in limited supply so that resource use by one user diminishes the availability for others), allowing all users to act in their own self-interest leads to degradation of the resource for all users (Hardin 1968).

While “sustainable management” is the purpose of the RMA, the Act provides no elaboration on how decision makers can apply this purpose. Amendments to the RMA since its enactment have been focused on efficiency of process rather than address the definition of sustainable management.

[94] The Treaty of Waitangi is the treaty first signed on 6 February 1840 by representatives of the British Crown and various Māori chiefs. It resulted in British sovereignty over New Zealand and is generally considered the founding document of the nation. There is a preamble and three articles. The first article addresses Crown sovereignty. The second article addresses Māori rights in land and other resources. The third article guarantees Māori the same rights as other British subjects (Waitangi Tribunal 2016).

It has been left to the courts to make an interpretation. The position from several court cases is that the application of Section 5[95] (the purpose of the Act) involves an "overall broad judgement" of whether a proposal will promote sustainable management of natural and physical resources (Skelton and Memon 2002).

Skelton and Memon argue "the fundamental tensions that underpin Section 5 arise from the challenge of crafting a definition of sustainable management that can enable decision makers (elected councils, the Environment Court, the Minister for the Environment) to reconcile the spectrum of values different groups accord the environment in a plural social setting. Such a definition needs to be sufficiently clear, procedurally fair and focused on the substantive goal of protecting and improving environmental quality" (Skelton and Memon 2002).

Water Management in Canterbury

With 58% of New Zealand's water for consumptive use allocated in Canterbury, water allocation is a significant issue for the region. With an area of 507,000 ha under irrigation, Canterbury has 70% of New Zealand's irrigated land and has land suitable to double that area. Water also creates and sustains Canterbury's world-famous braided rivers, high country and coastal lakes, as well as lowland streams and wetlands. However, with current methods of abstraction (primarily run-of-river offtakes and groundwater bores) reaching sustainability limits for many parts of the region, water allocation has also become contentious. In addition, cumulative effects of use are contributing to the declining ecological health of lowland streams and water quality in surface and ground water.

There has been a significant increase in irrigation in Canterbury. It was estimated in 1982 there were about 100,000 ha irrigated area in the region (Dommisse 2005). In 2015, this has increased to 507,000 ha (Brown 2016) - a five-fold increase in those 33 years. In recent years, there has been an 11% growth per annum in consented irrigated area.

Reliance on RMA processes has led to long, drawn-out and acrimonious processes to address water management issues. Also, the "overall broad judgement approach" has enabled arguments for resource use to be given preference to environmental protection by consent hearing commissioners and the Environment Court against the advice of the regional council. This has resulted in overallocation of surface and groundwater as well as degradation of water quality.

As well as the effects of water abstraction on reduced river flows and aquifer drawdown, there are concerns about the effects of storage particularly on the mainstems of alpine rivers, such as the reduction in braided river character, intrusion on areas of high naturalness, algal blooms downstream of storage, de-oxygenation in reservoirs, weed growth in reservoirs, reduced sediment transport and increased coastal erosion from decreased sediment supply (Jenkins 2007a). Principal concerns with land use intensification are water quality degradation in lakes, rivers and groundwater from increased nutrients (nitrogen and phosphorus), increased bacterial contamination, and increased sediment in the beds of rivers and lakes as well as suspended sediment.
Strategic investigations into water management commenced after droughts in the late 1990s indicated issues with water availability based on an analysis of future demand and supply (Morgan et al. 2002). This planner-led technical investigation indicated that, under low flow conditions in rivers from which irrigation water is taken, current peak demand cannot be met by current abstraction methods. Most irrigation abstraction was based on run-of-river schemes relying on direct withdrawals from rivers. On an annual basis, however, water is available to meet future demand but

[2] RMA s5 (1) The purpose of this Act is to promote the sustainable management of natural and physical resources. (2) In this Act, **sustainable management** means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and (b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and (c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.

would require major water storages for water to be available in the irrigation season. This finding led to further strategic investigations to identify sites for major water storage options for the region with respect to their hydrologic feasibility (Dark et al. 2008). This was also a planner-led technical investigation by consultants.

This was followed by an evaluation phase of the potential storage options by a 20-person multi-stakeholder group. This group was supported by sub-regional groups (for north, mid, and south Canterbury) who provided input to the evaluation. The multi-stakeholder group used a sustainability framework for comparing storage options. However, the multi-stakeholder group also expressed concerns about broader water management issues, and the multi-stakeholder group recommended that before strategic water storage and water management decisions are made, rigorous scientific and public consideration is required of:

- the impacts of land use intensification and its effects on water quality;
- mitigation and management systems for water quality; and
- methods for maintaining or improving flow variability and low flows in major rivers (Whitehouse et al. 2008).

The planner-led technical process with its limited focus on major storage to address the single issue of water availability had been found by the stakeholder response to be insufficient to address the broader water management issues, such as water quality and environmental flows. Furthermore, under the RMA, the process-led legal processes had been unable to effectively resolve the conflicting perspectives for water development in the region. For many planning decisions which involve multiple stakeholders with different values, the planner is unlikely to be the most appropriate person to identify all the issues to be addressed, the most appropriate way of addressing those issues, how the different interests can be reconciled, and, the appropriate weighting of multiple decision criteria. It is the stakeholders themselves that are better qualified to perform these tasks (Jenkins 2013). Thus planner-led technical decision-making is unlikely to be appropriate. Furthermore, in terms of process, planning authority processes to assess planning proposals typically involve consultation with affected parties, but the planning authority (or planning tribunal or court) is the arbiter between proponents and those affected (both supporters and opponents). However, these formal legal processes are unlikely to achieve reconciliation between proponents and affected parties. Indeed there is a tendency for these processes to be adversarial (Lomax et al. 2010). Thus process-led legal decision-making is unlikely to be appropriate. A different paradigm was needed.

Alternative approaches to designing decision-making processes which directly involve the range of stakeholders affected by planning decisions include collective choice arrangements described by Ostrom (Ostrom 1990) and deliberative democracy described by Dryzek (Dryzek 2010).

Collaborative governance approaches involve multi-stakeholder decision processes. There is not a "one-size-fits-all" formula; rather there is a framework of matters to be considered.
Work on collaborative approaches such as the Living Streams Programme had been initiated in 2004 by the Canterbury Regional Council at the scale of tributary catchments with considerable success at resolving water management issues at this scale (Gunningham 2008). It was clear that the Canterbury water management issues needed to be considered at multiple scales. For Canterbury, there were at least four spatial scales:

- the regional level where the key issues are water availability and land use intensification;
- the catchment level at which the sustainability levels of water use, the cumulative impacts of water use, and, the reliability of supply for irrigation are the main issues;
- the subcatchment level, where environmental flow requirements in river reaches and the management of stream water quality and riparian margins are the main issues; and

- the property level, where the land use practices that influence water quantity and quality are defined.

This led to the development of the Canterbury Water Management Strategy (CWMS). An overall strategic framework was formulated (Jenkins, 2007b) based on Ostrom's self-managed community approach to governing common pool resources[96] and Gunderson and Holling's concept of nested adaptive systems for managing natural resources.[97] One of the key elements of Ostrom's design principles for managing common pool resources, such as water, is the 'collective choice arrangements'. The community engagement process was based on Ostrom's concept of collective choice arrangements that was undertaken to facilitate collective decision-making for the CWMS.

Key elements of community engagement for the CWMS were: (1) The public engagement meetings throughout the region to identify stakeholder views on the uses and benefits of water in Canterbury. This led to defining ten target areas for water management.[98] The approach differs markedly from planner-defined objectives for regional plans or proponent-defined proposals for projects which, under RMA processes, limits public input to reactive comments. (2) The development of strategic options by the stakeholder steering group that were put out for public comment and feedback. This approach differs from the RMA where public input occurs after proposed plans or projects have already been defined. (3) The use of sustainability appraisal of the strategic options rather than effects assessment of a proposed development (Jenkins and Henley, 2014).

From a starting position where there was polarization of community views about whether water storage and associated land use intensification should proceed, there developed widespread support for the strategic framework for integrated water management that delivers on multiple targets. The strategy development process shifted from a focus on water availability and storage to identification of community values and the wide range of uses and benefits associated with water. Furthermore, the sustainability appraisal indicated that the status quo was not acceptable and that in order to achieve sustainability there is a need to improve management by existing users in relation to water use efficiency and land use practices with respect to their effects on water quality (Jenkins et al 2014). The acceptance of the strategy appeared to be related to the ability to be involved in and to influence the strategy development, as well as the outcomes of the process.

The implementation component of the CWMS Strategic Framework document (Canterbury Water 2009) contained the three key elements[99]: (1) a set of proposed immediate actions, e.g. the establishment of nutrient limits; (2) a set of investigations to deal with important areas of uncertainty, e.g. setting of catchment load limits; and (3) definition of the way that deferred choices

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[96] Ostrom (Ostrom 1990) considers institutional designs for common pool resources such as water. She compares different governance models: government direction, privatisation and self-managed communities. Her research indicates self-managed communities as the most enduring form of institutional design for common pool resources and identifies eight institutional design principles for self-managed communities: (1) Define clear group boundaries; (2) Match rules governing use of common goods to local needs and conditions; (3) Ensure that those affected by the rules can participate in modifying the rules; (4) Make sure the rule-making rights of community members are respected by outside authorities; (5) Develop a system, carried out by community members, for monitoring members' behavior; (6) Use graduated sanctions for rule violators; (7) Provide accessible, low-cost means for dispute resolution; and (8) Build responsibility for governing the common resource in nested tiers from the lowest level up to the entire interconnected system.

[97] Gunderson and Holling (Gunderson and Holling 2002) provide an operational framework for defining sustainability on the basis of an 'adaptive cycle" of exploitation of resources, accumulation of material, disturbances to the system and its potential to reorganise after disturbance. Adaptive cycles are 'nested' — operate at different spatial and time scales — but are linked.

[98] The ten target areas were: (1) Ecosystem Health/biodiversity; (2) Natural character of braided rivers; (3) Kaitiakitanga (Māori stewardship); (4) Drinking water; (5) Recreational and amenity opportunities; (6) Water-use efficiency; (7) Irrigated land area; (8) Energy security and efficiency; (9) Regional and national economies; and (10) Environmental limits.

[99] Note that these elements are the elements of a "commitment package" following the approach of "Strategic Choice", a decision-making methodology developed by John Friend (Friend and Hickling 2005) that was designed to address complex problem situations with multiple objectives, multiple stakeholders and incomplete information; this methodology was applied in CWMS decision making.

would be made, i.e. the continuation of the collaborative approach, at the local level through 10 Zone Water Management Committees, and at the regional level through a Regional Water Management Committee, with the development of zone and regional implementation programmes. The implementation of the Canterbury Water Management Strategy was based on the parallel development of proactive implementation programmes to achieve the multiple targets defined in the strategy framework document.[100] A nested system of a regional implementation programme (RIP) and ten zone implementation programmes (ZIPs) was created. The implementation programmes were not designed to be hierarchical. Rather the RIP was to address regional issues such as regional storage and distribution while the ZIPs were to address catchment issues such as land use practice improvements.

Zone Committees were joint committees of the regional council and the district and city councils in the zone. They comprised 6-7 community members who were locally based or had a special relationship with the zone, members of the rūnanga[101] within the zone, and council representatives. The Regional Committee was a committee of the regional council with representatives of local government, central government, Ngāi Tahu[102], community, a member from each zone committee, and an independent chair.

Like the Canterbury Water Management Strategy, the recommended programmes of the committees were non-statutory. Statutory backing of the Strategy was provided by a new Regional Policy Statement (Environment Canterbury 2013) and statutory backing for the implementation programmes is being provided by a new regional plan – The Canterbury Land and Water Regional Plan (Environment Canterbury 2015) – which is a nested document to match the regional and zone implementation programmes with a regional component for region-wide requirements and specific sections for each zone.

ZIPs have been progressively generated by Zone Committees within 12 to 18 months of being established and the Regional Committee produced a RIP. More recently a number of Zone Committees have prepared Addenda to their ZIPs. These documents have been focused on "solution packages" for some of the more difficult issues (primarily water quality issues for lakes) in the respective zones that had not been addressed in detail in the initial ZIPs. These Addenda are generating Plan Changes to the Canterbury Land and Water Regional Plan to incorporate the statutory components of the agreements reached in the zones as set out in the Addenda.

Operational management has introduced a new alternative to the RMA approach of the regulator setting consent conditions that are inspected for compliance by the regulator, to an approach reflecting Ostrom's principles.[103] The new approach was based on farmer collectives spatially defined by catchment boundaries or irrigation district command areas. It is a nested system based on the achievement of water quality targets in rivers and lakes which lead to catchment contaminant load limits defined as a collective responsibility; and with each farmer developing a farm environment plan to describe specific on-farm actions to meet farm management objectives and targets within an environmental management system for the collective. Each farmer is

[100] This contrasts with the approach envisaged under the RMA of relying on applicants' proposals for water resource development.

[101] Māori groupings centred on the whanau (family) and hāpu (sub-tribe) of marae (tribal meeting place) based communities.

[102] Ngāi Tahu is the Māori tribe whose rohe (tribal territory) includes the Canterbury region.

[103]

responsible for monitoring the actions undertaken and achievement of the targets which are audited by a certified farm plan auditor.[104]

The Four Stages of Collaborative Governance

The use of collaborative governance in Canterbury has evolved through several stages. It began with an experimental stage at the tributary and catchment scale before proceeding to a second stage of regional strategy development leading to the Canterbury Water Management Strategy. The third stage was the development of implementation programmes through the Region and Zone Committees. It is now entering a fourth operational stage focused on farmer collectives. The characteristics of these different stages are described below and then compared in relation to their dominant spatial scale, their governance arrangements, communication with stakeholders and the community, approach to decision making, funding, and the objectives they are trying to achieve.

Stage 1: Experimental stage at tributary and catchment level

With concerns about the inability of the RMA to provide the basis for managing water at sustainability limits and the increasing adversarial nature of court-based decisions, Environment Canterbury began to introduce the principles of Ostrom's "self-governing communities" to address water management issues. One programme was "Living Streams" commencing in 2003 that was targeted at tributary catchments with degraded water quality (Jenkins 2009). It was a council-led process of interaction with the community that had four phases (1) engaging the community and awareness raising, (2) achieving understanding within the community, (3) the community taking actions, and (4) monitoring and reviewing success. The work programme had three stages: firstly, an investigation stage involving data compilation and stream walks to produce a catchment report to identify water and land management issues; secondly, an involvement stage with landowners and community groups to develop an action plan for voluntary projects; and thirdly, an improvement stage of undertaking actions, securing funding, monitoring outcomes and reassessing the need for further action. For example, a five-year programme in the Pahau catchment including on-farm projects, riparian management projects and irrigation management improvements led to a three-fold reduction in bacterial contamination and a two-fold reduction in phosphorus concentration in the Pahau River. Participation was voluntary and decisions on actions were made by landowners and community groups. Participants funded the projects, often with financial assistance from the Council's Environmental Enhancement Fund. Monitoring of outcomes was by the regional council.

There were also collaborative catchment management programmes focused on resolving community conflict around water management issues. The programme was often initiated by community concerns being brought to the council's attention. The programme involved the following steps (1) getting stakeholder engagement to define issues and request information, (2) compiling information for stakeholder evaluation, (3) option development in consultation with stakeholders, (4) responding to requests for analysis and means of resolving differences, (5) reaching agreement and negotiating compromises, and (6) where needed, giving statutory backing to the agreements. This was achieved through open public meetings and in some cases with a community steering group. Agreed actions were implemented through funding by key participants and in some cases with council assistance. For example, to address algal blooms downstream of Opuha Dam, an agreement was reached between irrigators, the dam operator, conservationists and fishermen to

[104] This is based on the concept of audited self-management where (1) The environmental performance requirements were set by the regulator but industry was able to determine how to meet the requirements; (2) Industry was required to have an environmental management system (EMS) with independent certification (by either the regulator or independent certifier); (3) Industry was required to undertake measurements to demonstrate environmental performance requirements had been met with the measurements audited by an independent auditor (either the regulator or an independent auditor); and (4) The results of the measurements were to be publicly reported (Jenkins 1996).

provide flushing flows from the dam while allowing reduced minimum flows. The flow management actions were undertaken by the dam operator.

Stage 2: Strategy development at the regional level

The success of the collaborative approaches at the tributary and catchment scale noted above and the recognition of the need for community engagement in the forming of a regional strategy led to the Canterbury Water Management Strategy being developed in a collaborative governance framework. There was recognition of the need for a nested approach with four spatial scales of: the region, subregions related to interconnected catchments and groundwater zones, tributary catchments, and individual properties. However, the focus was at the regional scale and the governance structure was at the regional scale with oversight by the Canterbury Mayoral Forum (the mayors of the city and district councils in the region, the chair of the regional council, and the chief executives of the councils) and a multi-stakeholder group with members selected from across the region.

Reliance on open meetings for community engagement was not logistically possible for a region about 400km in length and 100km in width. A programme of structured stakeholder engagement and region-wide community consultation was developed (Jenkins and Henley 2014). Decision making was by the multi-stakeholder steering group informed by community input and then endorsement by the Mayoral Forum. Funding of the strategy development was by the regional council with some minor assistance by central government in the latter stages of strategy finalization.

Stage 3: Implementation programme development

The CWMS defined the governance structure for the development of implementation programmes for the strategy. It was a nested (rather than hierarchical) system with a Regional Committee to recommend programmes relevant to regional issues (such as water storage and distribution across the region) and ten Zone Committees to recommend programmes relevant to subregional issues (such as changes in land use practices to improve water quality).

The Zone Committees are joint committees of the regional, district and city councils in the zone area and each council is represented on the Zone Committee. Rūnanga whose rohe is in the zone area are represented on the committee. Applications are sought for 4-7 community members. Applicants are assessed on skills, expertise and experience as well as their ability to work together to develop water management solutions that deliver economic, social, cultural and environmental values. The community members need to include people with a range of backgrounds and interests in the community. The purpose of the committee is to facilitate community involvement in the Zone Implementation Programme (ZIP) and monitor progress of the ZIP implementation (Canterbury Water undated). The objectives of the Zone Committee include developing the ZIP and overseeing its delivery, as well as engaging stakeholders and ensuring community input to the ZIP. Decisions are by consensus. If consensus cannot be reached, then the committee is to be replaced. There is a code of conduct which defines the operating philosophy for a collaborative, co-operative, participatory and solutions-focused approach by all members (Canterbury Water 2014). The operations of the Zone Committees are funded by the regional council with contributions from the city and district councils.

The Regional Committee is a committee of the regional council with 2 regional council members, a member of Christchurch City Council, 3 district council members (one from a southern, central and northern district council), one representative from Ngāi Tahu, three rūnanga representatives (one from South, Mid and North Canterbury, 5 to 7 community representatives bringing expertise related to fisheries, energy, biodiversity, agriculture, recreation and regional development, with observers from central government and Canterbury District Health Board. The purpose of the Regional Committee is to monitor progress of CWMS implementation and provide advice on regional issues. It has a similar decision making and operating philosophy as the Zone Committees.

The dominant component of the implementation programme development stage has been at the zone level.

Stage 4: Operational management

In relation to operational management the focus has been on water quality in rivers and lakes. The main operational elements are having farmers adopt good management practice, setting nutrient contaminant limits with respect to rivers and lakes, linking these river and lake limits to catchment nutrient loads, and, allocating the catchment loads among existing users while trying to create headroom for new users. The primary governance element is the establishment of farmer collectives based on irrigation districts, tributary catchments (or stream allocation zones), or farm enterprises. Collectives need an approved Environmental Management System (EMS) that defines water quality outcomes for the collective consistent with regional plan requirements. The EMS also requires an inventory of nutrient loss rates, identification of the nutrient risks and how those risks will be managed including a statement of best nutrient management practices. The EMS also defines the contractual arrangements with members including a Farm Environmental Plan (FEP) consistent with the EMS, and, how the FEPs will be audited and compliance achieved. The FEP has to address irrigation management, soils management, nutrient management, effluent management as well as wetland and riparian management. The compliance approach is based on audited self-management. This includes an audit process of assessing performance against management actions and outcomes at the individual property level. The EMS sets out the record keeping requirements, how audit results will be fed back to members and shared with the wider community and how issues of poor performance are to be managed.

Comparison of Collaborative Governance Stages

The four stages are compared in Table 1. In terms of scale, the evolution has been from the first experimental stage as small scale (tributary and catchment) addressing specifics issues to the second stage of region-wide strategy looking at multiple issues. For the third stage of implementation programme development, the dominant scale was at the sub-regional zone scale focused on achieving the ten target areas identified in the CWMS. The fourth stage of operational management involved farmer collectives at the tributary or irrigation scheme scale with an emphasis on management practices for water quality management.

The governance arrangements were relatively informal at the first experimental stage with Living Streams based on voluntary council-led informal meetings and slightly greater formality with catchment groups. The second stage strategy development was non-statutory but with increasing formality under the Mayoral Forum (a non-statutory body) and the multi-stakeholder steering group as well as structured stakeholder engagement and community consultation across the region. The CWMS, although non-statutory, has been influential over the last seven years in framing water management in the region. The third stage of implementation programme development was more formal as the Region and Zone Committees were constituted under the Local Government Act. The RIP and ZIPs, although themselves only advisory documents, led to statutory backing under the Land and Water Regional Plan. Even greater formality characterizes the fourth operational stage associated with the farmer collective approach. This involves the formation of Collectives, setting water quality outcomes, and defining the contents of EMSs and FEPs as set out in the Canterbury Land and Water Regional Plan (Environment Canterbury 2015).

With respect to decision making and funding, for the Living Streams programme in the experimental stage there was a need for sufficient landowner support for a programme to proceed. Decisions and funding of actions was a voluntary decision of landowners albeit with the possibility of a contribution from the regional council's Environmental Enhancement Fund. Decisions for catchment groups were by consensus among the stakeholders participating, with funding typically borne by the stakeholders with some funding of components by the regional council. For the regional strategy, the decisions

were made by agreement among the multi-stakeholder steering group influenced by community input and endorsed by the Mayoral Forum. Funding of the process and investigations was primarily by the regional council. Similarly funding and staffing for the Region and Zone Committee processes was primarily by the regional council. The recommendations of the Region and Zone Committees on ways to achieve the ten targets areas are advisory. The statutory components have to be drafted by the regional council and are then subject to RMA hearing processes. The funding implications of the implementation of the decisions were borne by water users (in relation to land and water management requirements) and by the regional council (in relation to biodiversity programmes and further investigations). For the farmer collectives, the members could define their own governance arrangements within the requirements of the regional plan and could choose the management approaches to deliver the outcomes specified in the regional plan.

Table 1 Four Stages of Collaborative Approaches in Canterbury Water Management

Collaborative programme	Dominant spatial scale	Governance	Communication	Decision making	Funding	Objective
Experimental Stage						
Living streams	Tributary	Regional council led informal meetings	Voluntary participation	Participant decision on actions taken	Participant assisted by Environmental Enhancement Fund	Water quality improvement in degraded streams
Catchment groups	Catchment	Regional council led regular meetings	Open meetings	Community consensus	Participant and Council funding	Resolution of conflict or community concerns
Regional Strategy Development						
Canterbury Water Management Strategy	Region	Mayoral forum led. Appointed stakeholder Steering Group	Structured stakeholder engagement. Region-wide community consultation	Steering Group informed by community with Mayoral forum endorsement	Regional Council	Regional water management strategy
Implementation Programme Development						
Regional Implementation Programme	Region	Regional council appointed committee	Open public meetings	Committee consensus which is subject to RMA processes	Regional council	Regional Implementation Programme
Zone Implementation Programme	Subregional zones	Regional and district council appointed committee	Open public meetings and community engagement	Committee consensus which is subject to RMA processes	Regional and district councils	Zone Implementation Programmes
Operational Management						
Farmer Collectives	Tributary or Irrigation District	Collective and farmer audited self-management	Collective	Collective strategy and farm plans to meet Regional Plan limits	Farmer/Collective	Achieve water quality outcomes

There is a clear trend in the collaborative governance arrangements as water management moves from strategy to implementation programme to operational management of (1) decreasing dominant spatial scale (from region to subregional zone to catchment/irrigation district), (2) increasing formality (from non-statutory to statutory), and (3) decreasing scope of decisions (from all issues to ten target areas to selection of management approach).

Even with the decreasing dominant spatial scale moving from strategy to operations, multiple scales from the region to the individual land parcel are relevant to all stages. The solutions packages from the Zone Committee addenda include major infrastructure components at the catchment scale (e.g. augmentation of Wainono Lagoon with high quality Waitaki River water, managed aquifer recharge in the Hinds catchment, a sedimentation basin in the Wairewa catchment, and, constructed wetlands for water quality improvement in the St Leonards catchment). There is not a funding mechanism identified or an implementation agency specified for this infrastructure.

Furthermore the Regional Committee recognized that while new water supply and distribution projects must be economically viable, these infrastructure elements need to be developed in a coordinated way to achieve an integrated regional approach (Canterbury Water 2012). This concept is given statutory support in Policy 4.8 of the Land and Water Regional Plan that "the harvest and storage of new irrigation or new hydro-electricity generation schemes contribute to or do not frustrate the attainment of the regional concept for water harvest, storage and distribution…" (Environment Canterbury 2015). The Regional Committee also saw the potential for water quality improvements and other benefits through the development of 'environmental infrastructure' such as constructed wetlands and on-farm treatment swales that can be incorporated into water storage and supply networks (Canterbury Water 2012). However, there is not an operational programme for implementing and funding the regional concept.

Also, the solutions packages being developed by the Zone Committees fall short of the targets defined in the CWMS. Furthermore, while the progress of the implementation of the CWMS has been significant, not all the milestones identified for completion by 2015 have been achieved. These unresolved issues of infrastructure development, ability of solutions packages to meet desired outcomes, funding of infrastructure and solutions packages, and implementation progress are discussed further below.

Unresolved Issues

The change to collaborative governance has led to a paradigm shift in water management in Canterbury with the constructive development of Zone Implementation Programmes to deliver on the ten target areas of community outcomes associated with water, and of solution packages to address degraded water quality. However, there are still unresolved issues with respect to delivering sustainable outcomes.

Each of the Zone Committees in presenting their solution packages have indicated that water quality will improve or at least the rate of degradation will decrease, but the levels of intervention proposed are not sufficient to achieve the desired water quality targets. One key consideration is the cost to farmers of implementing land management changes to achieve lower contaminant discharges. While more advanced mitigation approaches are available, the Zone Committees (many of whom are farmers) were reluctant to recommend measures greater than what was considered "affordable" to farmers.[105] It is unresolved how additional interventions will be achieved.

[105] Note that the impact of water quality impairment is not borne by farmers but by downstream in-river users (e.g. fishermen and kayakers) and the environment (e.g. algal blooms and nitrate toxicity). This is a different "commons" management issue compared to the issue considered by Hardin and Ostrom of a resource whose availability is at sustainability limits affecting all users.

The solution packages also include catchment level infrastructure (e.g. managed aquifer recharge, constructed wetlands and diversions of clean water for contaminant dilution). It is unresolved as to who would be responsible for implementing this infrastructure. Central government has no water management agency (only an environmental policy ministry). Regional government has a regulatory role. There is no incentive for private sector implementation. In addition, the question of the method of funding is unresolved. No recommendations for funding have been developed either on a polluter pays basis or a taxpayer/ratepayer basis.

Another unresolved issue is the uneven implementation of actions identified in the Canterbury Water Management Strategy to address the ten target areas. The activities related to increased irrigated area and economic outcomes are being actively progressed, but the activities associated with recreational and ecological objectives are behind the agreed implementation schedule in the Strategy (Canterbury Water 2015). The agreement reached in the Strategy is seen as a "social contract" with the multiple interests around water (Henley 2014) and all activities cited in the Strategy need to be implemented for an equitable outcome.

Managing power imbalances can be an issue for effective collaborative governance (Fung and Wright 2003). There is concern that the Zone Committee process favours the well-resourced farming interests over the less resourced recreational and ecological interests. Some community interests have withdrawn from the collaborative process.

Concluding comments

In Canterbury, there has been a paradigm shift to collaborative governance leading to more effective water management for a resource at sustainability limits compared to the effects-based approach in New Zealand's resource management legislation. Different institutional structures for different stages of the water management process have been used but all reflect the principles of self-governing communities. However, there are still issues to be resolved to achieve sustainable water management.

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